Time-of-Travel and Dye-Dispersion Studies of Selected Streams and Lakes in the Oswego River Basin, New York

1967-75

REPORT OF INVESTIGATION

RI-17

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

TIME-OF-TRAVEL AND DYE-DISPERSION STUDIES

OF SELECTED STREAMS AND LAKES IN THE

OSWEGO RIVER BASIN, NEW YORK, 1967-75

By

Harold L. Shindel, Lloyd A. Wagner, and Paul H. Hamecher

U.S. Geological Survey

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Prepared by
UNITED STATES DEPARTMENT OF THE INTERIOR
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IN REPORT TO INTERNATIONAL SYSTEM (SI) UNITS

Multiply English units	By	To obtain SI units
Length		
inches (in.)	2.540	centimetres (cm)
feet (ft)	.3048	metres (m)
miles (mi)	1.609	kilometres (km)
Area		
square feet (ft^2)	0.0929	square metres (m^2)
Volume		
gallons (gal)	3.785	litres (l)
cubic feet (ft^3)	.02832	cubic metres (m^3)
ounces, fluid (oz)	.02957	litres (l)
Temperature		
degrees Fahrenheit (°F)	(°F-32) 5/9	degrees Celsius (°C)
Flow		
cubic feet per second (ft^3/s or cfs)	28.32	litres per second (l/s)
cubic feet per second (ft^3/s)	.02832	cubic metres per second (m^3/s)
gallons per minute (gal/min)	0.06308	litres per second (l/s)
million gallons per day (Mgal/d)	.04381	cubic metres per second (m^3/s)
feet per second (ft/s)	.3048	metres per second (m/s)
Weight		
pounds (lb)	0.4536	kilograms (kg)
Concentration		
parts per billion (ppb)	1.0	micrograms per litre (µg/l)
Combinations		
feet per mile (ft/mi)	.1894	metres per kilometre (m/km)

SYMBOLS, UNITS OF MEASURE, AND ABBREVIATIONS USED IN TEXT

C	numerical constant
n	factorial constant
Q	discharge, in cubic feet per second
T_e	estimated time of travel of peak, used for dye injection, in hours
T-T	time of travel, in hours and decimal hours
V_d	volume of dye injected, in ounces

ABBREVIATIONS USED IN COMPUTER TABLE

A	at
BR	bridge
C	canal
CANA	Canandaigua
CFS or ft^3/s	cubic feet per second
CH	county Highway
CR	creek
CTR	center
DS	downstream
E	east
FT	foot
FT/S	feet per second
HR	hour
I	island
MO	month
NO	number
N	north
OT	outlet
R	river
RD	road
RR	railroad
S	south
SH	state highway
SK	Skaneateles
SK FS	Skaneateles Falls
ST	street
TP	treatment plant
TRIB	tributary
T-T	time of travel
US	upstream
WWTP	wastewater-treatment plant
YR	year
YW	yellow
°	degrees
'	minutes
"	seconds

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ABSTRACT

Time of travel was determined for reaches of 21 streams in the Oswego River basin, and dispersion of dye was traced in Cross and Onondaga Lakes. Two harmless dyes, rhodamine B and rhodamine WT, were used as tracers. Relations of discharge to time of travel of leading edge, peak, centroid, and trailing edge (at 10 percent of peak of dye cloud) through the subreaches are shown in graphs for streams on which more than one time-of-travel run was made. Velocities of peak dye concentration ranged from 0.05 to 2.36 feet per second (0.015 to 0.720 metres per second). Water-surface profiles and graphs showing cumulative time of travel of peak dye concentration are presented for all reaches studied, and time-of-travel data for each subreach are given in tabular form. Curves showing the relation between time and dye concentration, derived from instantaneous dye injections, were determined for many sites within the reaches studied.

INTRODUCTION

Streams of New York State carry large amounts of dissolved and suspended waste materials. The time needed by a stream to move these materials from point to point is called the time of travel, which is a function of discharge and geometry of the stream. During this time, physical and biological mechanisms such as dilution and decomposition reduce the effects of the added materials.

Time-of-travel data have several applications. For example, they can help planners to evaluate a stream's ability to assimilate waste and to cleanse itself of waste materials. The data are also useful in water-quality studies that require samples of the same slug of water as it moves from headwater to mouth. This can be done by arranging the sampling schedule to correspond to the stream's time of travel. The data are also useful if a contaminant is accidentally spilled upstream from a municipality that obtains its water supply from that stream. From time-of-travel data, municipalities can determine when to stop pumping water from the streams while the contaminant passes, and when to resume pumping after it has passed.

Time of travel may be measured by using floats, by analyzing average stream velocities at selected cross sections, or by tracking various chemicals. The chemical-tracking method, which uses fluorescent-dye tracers, is the most accurate and was used in the time-of-travel studies described in this report. Fluorescent dye was injected into a stream (or lake), and the water was periodically sampled at a downstream point until the cloud of dye had passed. The time necessary for the peak concentration of the dye to travel from the injection point to the sampling point is the peak time of travel between those points. The fluorescent-dye method is explained more fully in the section "Procedures."

Although many dye tracers are available for time-of-travel studies, the U.S. Geological Survey in New York has generally used a 40-percent solution of rhodamine-B or a 20-percent solution of rhodamine-WT. These tracers were chosen for their high detectability, economy, ease of handling and injection, and nontoxicity in the concentrations used. Since the early 1970's, the U.S. Geological Survey in New York has used rhodamine-WT dye exclusively. This dye is more expensive than rhodamine-B but is preferred for dispersion studies because it has a higher recovery rate than rhodamine-B (Kilpatrick, Martens, and Wilson, 1970). Rhodamine B was used in this study during 1967, after which rhodamine-WT was used exclusively.

Scope of Report

Time-of-travel data for 21 selected streams in the Oswego River basin and dye-dispersion data for Cross Lake and Onondaga Lake are presented. These data were obtained from 1967 to 1975. Figure 1 shows the Oswego River basin and the location of streams and lakes studied.

In the following sections, "Procedures," "Method of Analysis," and "Flow Duration," general methods and types of analysis used in time-of-travel studies are described, and a list of selected references is given.

The major part of this report consists of illustrations, tables, and descriptions of field observations for each subbasin and reach studied. Data on the streams and lakes are listed in downstream order, and data on tributaries are given with the main-stream data in the order in which those tributaries enter the main stream. (This is the manner in which streams are listed in U.S. Geological Survey surface-water data reports.) Thus, Catharine Creek, the principal stream feeding Seneca Lake, is considered to be the head of the Oswego River (see fig. 1).

The time-of-travel information and related computations obtained during this study have been compiled for computer use. The computer printout is included at the end of this report as a two-part table listing the streams and lakes in downstream order. Table 1A contains information on site location, dye injection, and stream discharge; table 1B contains time-of-travel data.

The degree of analysis possible differs for each stream. At least two time-of-travel measurements, each at a different flow, are needed to derive curves showing relations of discharge to time. Thus, for streams on which only one measurement was made, it was not possible to develop these curves.

PROCEDURES

Before each dye study was begun, field and map reconnaissance was done to select the subreaches and measure their length and to plan the sampling schedule. Length of the subreaches was measured on the largest scale U.S. Geological Survey topographic map available. Slope of the streams was determined by dividing the change in elevation (also obtained from the topographic maps) by the length of the study reach. The slope gives an indication of the speed at which water will travel; steep slopes indicate shorter time of travel than gradual slopes.

The field procedure consisted of injecting a predetermined amount of dye solution into the stream at a selected site and taking samples at predetermined time intervals at a downstream sampling site. This was done for every subreach. The volume of dye to be injected was computed to produce a peak concentration of less than 10 µg/l at the downstream site.

Water samples were collected in 5-oz (148-ml) glass vials by a technician or were obtained by a floating, automatic water sampler that collected the water in plastic syringes. The samples in both methods were taken from just below water surface in the center of the main flow of the stream.

After the water samples were taken at the site, a 5-ml sample was analyzed in a fluorometer to determine the presence or absence of dye; the rest of the original samples were saved for later analysis in the laboratory, where temperature of sample and instrument can be held constant. The fluorometer is basically an optical bridge that uses a rotating prism to relate the fluorescense of a sample to a calibrated

rear light path. The fluorometer is calibrated with prepared standards. Dial readings vary linearly with the amount of fluorescence. The fluorometer may be used with either a flowthrough door to give a continuous reading or with individual sample cuvetts. Both techniques were used in these time-of-travel and dye-dispersion studies. For the two lake (dye-dispersion) studies, the fluorometer was equipped with a flow-through door, intake and discharge hoses, a portable pump, a power supply, and a strip-chart recorder to produce a continuous record of dial readings and was mounted in a boat to obtain a dye profile along a traverse. During the traverses, water was pumped at a constant rate from a fixed depth through the fluorometer. Random samples of water were taken from the discharge hose for later calibration of recorder readings.

The time interval between injection and the first arrival of dye at the sampling site is called the leading-edge time of travel, the time until arrival of maximum concentration is the peak time of travel, the time until arrival of the center of the dye cloud is the centroid time of travel, and the time until arrival of 10 percent of the maximum concentration is the trailing-edge time of travel. Decimal (24-hour) time was used for computer computations. A typical curve showing variation in dye concentration with time is shown in figure 2. The centroid data are computed from this type of curve. Curves showing the relation between time and concentration for each sampling site are not included in this report but are on file in the Albany, N.Y. office of the U.S. Geological Survey.

Discharge figures were obtained from gaging-station records and miscellaneous discharge measurements. For many subreaches, discharges were interpolated on the basis of drainage areas. Mean daily discharge records used in these studies are published in the annual U.S. Geological Survey report, "Water Resources Data for New York." Locations of gages, injection sites, and sampling sites in each study reach are shown in corresponding figures in the text.

METHOD OF ANALYSIS

Time of travel

To establish the relation of discharge to time of travel, at least two measurements of the time of travel are required, each at a different rate of discharge. On many of the streams, a second measurement was not feasible. If, in the future, measurements are obtained during a different discharge range, the new data will be published as an addendum to this report. Results of the measurements obtained during this study are shown in tables that list dates; discharges; times of travel of leading edge, peak, centroid, and trailing edge; and the velocities for the leading edge, peak, and centroid.

Where two or more time-of-travel measurements were available, a curve showing the relation between discharge and time was derived to show the time of travel for a range of discharges. A straight-line-log relationship of discharge to time was made for leading edge, peak, centroid, and trailing edge for reaches that had two measurements, from the formula

$$T\text{-}T = CQ^n$$

where $T\text{-}T$ = time of travel
Q = discharge (ft^3/s)
C = numerical constant
n = factorial constant

Although previous studies generally have found a slight deviation from this straight line, the discharge/time curves derived from the formula $T\text{-}T = CQ^n$ can generally be considered a close approximation of actual conditions for flows during which measurements have not been made. However, traveltimes computed from long extensions of discharge/time curves may be inaccurate.

Discharges listed in the time-of-travel data tables are for injection or sampling sites unless otherwise noted. Discharge values used in the illustrations are for sampling sites unless otherwise noted.

FLOW DURATION

A flow-duration curve is a means of describing the temporal distribution of daily mean flows that have occurred and can be used to predict the distribution of flows that may occur. The curve shows the relation between flow and the percentage of time that it was equaled or exceeded. For example, a 90-percent-duration flow would indicate a low flow, one that has been equaled or exceeded 90 percent of the time. Similarly, a 10-percent-duration flow would indicate a high flow, one that had been equaled or exceeded only 10 percent of the time. In pollution studies, low-flow periods are the ones of greatest concern because the streams during such periods have less water with which to dilute a pollutant. Generally, a flow of 75-percent or higher duration indicates low-flow conditions. Flow-duration curves are given for all streams that had a gaging station in the reach studied.

A satisfactory curve showing the relation between discharge and time-of-travel can usually be obtained by measuring time of travel at three selected discharge rates. To permit accurate definition of the low-discharge end of the curve (the part most critical in pollution problems), one of the measurements should be made near the 95-percent or higher duration point. Other measurements should be near the 50-percent duration point and at about the 75-percent duration.

NOTE ON USE OF DISCHARGE VALUES

Discharge values for gaging stations in the study reaches may be obtained from the U.S. Geological Survey office in Albany, N.Y. Time of travel of a water-borne contaminant spilled into a stream can be estimated from gaging-station discharge values and the appropriate curves showing relations between time and discharge.

Data in this report should not be used during a period of rapidly changing discharge or when the discharge exceeds those in the time/discharge curves. To obtain the time of travel at a discharge other than those measured, a second or third measurement is needed in order to define the time of travel and to draw a discharge/time curve or extend a previous curve.

ALPHABETICAL LIST OF STREAMS AND LAKES

The alphabetical list below is provided to help the reader locate data for a specific stream or lake. In the section that follows, data for each stream or lake are given in downstream order.

Catharine Creek Basin

Description of Reach

Catharine Creek flows north through the reach Millport to Seneca Lake at Watkins Glen (fig. 3). A diversion channel built to divert floodwater from the village of Montour Falls is part of the reach. Slope of the study reach extending from Millport to Watkins Glen averages 29 ft/mi.

Analysis

Discharge of Catharine Creek basin was measured at several sites. Results of these measurements are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
South Genesee Road	9-22-70	09.17	10.9
Upstream from Highway 14	9-22-70	09.92	13.0
Old channel near State Highway 14	9-22-70	10.42	1.19
Shequaga Creek downstream from falls at Montour Falls	9-22-70	11.58	.87

Base-flow conditions prevailed during the study period.

Time of travel.--One time-of-travel measurement was made for Catharine Creek at low flow. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 4.

Keuka Inlet Basin

Description of Reach

Keuka Inlet Tributary 3 rises near the wastewater-treatment plant of The Taylor Wine Co., Inc., at Pleasant Valley, and flows east to the confluence with Keuka Inlet (fig. 5). The Inlet flows nearly 1 mi (1.6 km) east to Keuka Lake. Slopes of subreaches extending from the wastewater-treatment plant to the mouth of Keuka Inlet Tributary 3 average 27 ft/mi (5.1 m/km) and, from the mouth of Tributary 3 to the mouth of Keuka Inlet, 2.5 ft/mi (0.5 m/km).

Analysis

Discharge of Keuka Inlet and Keuka Inlet Tributary 3 was measured at several sites. Results of these measurements are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
	Keuka Inlet Tributary 3		
5 ft upstream from wastewater-treatment plant at Pleasant Valley	7-10-74	11.97	0.05
10 ft downstream from wastewater-treatment plant at Pleasant Valley	7-10-74	12.20	.32
Dead-end road	7-10-74	10.45	.20
	Keuka Inlet		
10 ft upstream from confluence with Tributary 3	7-10-74	13.85	5.16
20 ft downstream from confluence with Tributary 3	7-10-74	14.45	5.08

Base-flow conditions prevailed during the study period.

The source of most of the flow in Tributary 3 at the time of this study was from a wastewater-treatment plant. Variation in discharge with time at the plant is shown in figure 6. Discharges were computed from an effluent flowmeter chart obtained from the company.

Time of travel.--One time-of-travel measurement was made for the combined subreaches from the wastewater-treatment plant to State Highway 54A. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 7.

Keuka Lake Outlet

Description of Reach

Keuka Lake Outlet begins in the northeast corner of Keuka Lake and flows northeast to Seneca Lake (fig. 8). Slope of the study reach from Penn Yan to Dresden averages 42 ft/mi (12.8 m/km).

A duration curve is presented for the gaging station in figure 9. Arrows show the approximate duration at which the time-of-travel measurements were made.

Analysis

Discharge of Keuka Lake Outlet was measured on Aug. 26-28, 1969, at the gage at Dresden. Discharge is regulated by gates at the dam for Keuka Lake. Results of these measurements are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Gage at Dresden	8-26-69	08.88	65.0
Gage at Dresden	8-27-69	08.75	13.3
Gage at Dresden	8-27-69	09.42	13.7
Gage at Dresden	8-28-69	07.83	50.4

Base-flow conditions prevailed during the study period.

Time of travel.--Three time-of-travel measurements were made for Keuka Lake Outlet. Data for injection sites are shown in table 1A; those for sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 10-12. Discharge used in figures was measured at gage. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentrations are shown in figure 13.

Cayuga Inlet

Description of Reach

Cayuga Inlet flows generally north through the study reach Buffalo Street to navigation light 150, in Cayuga Lake (fig. 14). Beginning at Ithaca, the Inlet flows in two channels for about 0.5 mi (0.8 km) before emptying into Cayuga Lake.

Analysis

Time of travel and dye dispersion.--In this study, 2.5 gal (9.5 L) of rhodamine WT 20-percent dye was injected into the outfall pipe at the Ithaca Sewage Treatment Plant. The outfall pipe empties into Cayuga Inlet near the mouth of Cascadilla Creek. As the dye dispersed in the Inlet, a fluorometer equipped with a flow-through door on board a powerboat was used to locate the dye. Several traverses were made with the boat during the 4-day period after injection of the dye. As shown in figures 15-17, the highest concentration of dye stayed in the vicinity of the mouth of Cascadilla Creek during the 4-day study period; some of the dye traveled upstream. This was due in part to a northeasterly wind during most of the study period. A low concentration of dye (1 mg/L) was found at navigation light 150 on completion of the study (fig. 16).

Dye-colored water samples were collected at 2-ft (0.6-m) vertical intervals from the surface to the bottom of the Inlet at several sites. Water temperature was measured at 2-ft (0.6-m) vertical intervals at two of the sites.

Figures 18-22 show by graph that dye concentrations recorded during the vertical sampling ranged from 0.5 to 10.5 mg/L. Figures 20 and 21 show that water temperatures in the two vertical samplings ranged from 11.2 to 11.7°C.

Several discharge measurements were made in the Cayuga Inlet basin during the study period. Results of these measurements are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Cayuga Inlet near Ithaca (upstream from Buttermilk Creek)	10-8-74	11.00	11.4
Buttermilk Creek near Ithaca (State Highway 13)	10-8-74	11.58	1.8
Sixmile Creek at Ithaca	10-8-74	10.80	5.3

Base-flow conditions prevailed during the study period.

Readings obtained from the Geological Survey gage on Cayuga Lake near Ithaca indicate that the mean daily decrease in elevation of the lake during the study period was 0.11 ft (0.03 m).

Fall Creek

Description of Reach

Fall Creek flows southwest through the study reach, State Highway 366 to Stewart Park footbridge before emptying into Cayuga Lake (fig. 23). Slope of the subreach from State Highway 366 to Etna averages 10 ft/mi (1.9 m/km); slope of the subreach from base of Beebe Lake dam to Stewart Park footbridge averages 259 ft/mi (49.0 m/km).

Analysis

Discharge for Fall Creek was computed from the results of a discharge measurement at Etna and from the gaging-station record near Ithaca. Results of the discharge measurement are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Fall Creek at Etna	10-9-74	13.25	55.3

Base-flow conditions prevailed during the study period.

A duration curve is presented for the gaging station in figure 24. Arrows show the approximate duration at which the time-of-travel measurements were made.

Time of travel.--Previous time-of-travel studies were done in Fall Creek basin in 1963 (Dunn, 1964). One time-of-travel measurement was made there during this study in 1974. Data for injection sites for the 1974 study are shown in table 1A; for sampling sites, in table 1B.

Relation of the varying discharges to time of travel of the peak dye concentration for the subreach State Highway 366 at the mouth of Virgil Creek to Etna is shown in figure 25. The curve is from Dunn (1964).

Fish Creek

Description of Reach

Fish Creek rises in the area west of East Bloomfield and flows northeast to East Victor, where it empties into Mud Creek. The reach in which the time-of-travel study was done begins at the outlet of the East Bloomfield-Holcomb Sewage Treatment Plant (fig. 26, site 562), which empties into a tributary of Fish Creek about 0.4 mi (0.6 km) upstream from Fish Creek (fig. 27). The reach continues downstream to sampling site 574, where Fish Creek and State Highway 96 intersect. Slope of the study reach averages 41 ft/mi (7.8 m/km).

Site numbers shown on the map and graph are those assigned to sampling sites by the New York State Department of Environmental Conservation.

Analysis

Discharge of Fish Creek was measured at various sites. Results of these measurements are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Victor-Holcomb Road (565)	12-5-73	11.63	2.51
Pound Road (567)	12-5-73	15.08	2.54
Brace Road (571)	12-5-73	12.17	3.07
State Highway 96 (574)	12-5-73	13.33	2.98

Base-flow conditions prevailed during the study period.

Time of travel.--One time-of-travel measurement was made for Fish Creek in 1973. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative time curves for the time of travel of the peak dye concentration are shown in figure 27.

Ganargua Creek Basin

Description of Reach

Mud Creek and Great Brook merge just north of East Victor and become Ganargua Creek, which flows northeastward through Macedon. Approximately 2 mi (3.2 km) downstream from Macedon, Ganargua Creek joins the Erie Canal (part of the New York State Barge Canal System and locally called the Canal), at Lock 29 at Yellow Mills (fig. 28). The creek continues as part of the canal system to a relief spillway 2 mi (3.2 km) east of Palmyra. Here the creek assumes its own identity, flows in a loop north of the canal, and finally merges with the canal 0.3 mi (0.5 km) west of Lock 27 at Lyons (fig. 29).

While the canal is in operation, Ganargua Creek below Lock 29 is fed by water diverted from the Niagara River basin through the canal.

Slope of the study reach from Mud Creek at East Victor to Ganargua Creek at Yellow Mills averages 10 ft/mi (1.9 m/km); slope of the study reach from Ganargua Creek at Hogback Road to Lock 27 on Erie Canal at Lyons averages 1.7 ft/mi (0.3 m/km).

Analysis

Discharges for the Ganargua Creek basin were measured at several sites and obtained from the gaging-station record for Mud Creek at East Victor. Results are shown in the facing table:

Time of travel.--One time-of-travel measurement was made for the study reach upstream from the canal at Yellow Mills, and two measurements downstream from the canal were made near Palmyra. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Discharge is plotted against time-of-travel of leading edge, peak, centroid, and trailing edge in figures 30 and 31 for two of the lower subreaches.

Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figures 32 and 33 for each study reach. The peak time of travel during the 1975 study for Hogback Road to Town Line Road was determined by subtracting the peak time of travel for subreach Town Line Road to State Highway 88 from the peak time of travel for subreach Hogback Road to State Highway 88.

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Gillis Road at Brownsville	7-20-71	12.16	24.1
Wilson Road near Macedon	7-20-71	11.50	29.3
Erie Road at Macedon	7-20-71	10.15	47.9
	8-05-71	8.58	10.7
East Palmyra	1-15-75	9.21	64.0
State Highway 88 at Newark	11-16-67	9.42	564
Zurich Road near Newark	1-15-75	11.48	155

Base-flow conditions prevailed during the August 1971 study period but not during the other studies.

Discussion

In the plot of dye concentration against time (fig. 34) for the subreach from Macedon to Yellow Mills, the data points are scattered. This may be a result of canal operation. For example, an increase in flow from the canal at the time the dye reached the sampling site on July 20, 1971, could have caused the dye to move upstream. On August 5, 1971, time of travel of the subreach was rerun at a lower flow than the previous one, with a sampling site 0.4 mi (0.6 km) upstream from the earlier site. The dye concentration curve plotted for the second study did not show a large scatter of points.

In tables 1A and 1B, the figures for miles upstream from mouth are based on miles upstream from the mouth of Clyde River.

West River Basin

Description of Reach

Naples Creek flows northeast from State Highway 245 to its confluence with West River. West River then continues north to Canandaigua Lake (fig. 35). Slope of the study reach from State Highway 245 to near the mouth of West River averages 10.3 ft/mi (2.0 m/km).

Analysis

Discharges for the West River basin were measured on Naples Creek at State Highway 245 and are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Naples Creek at State Highway 245	9-15-70	09.67	64.7
	9-15-70	13.83	34.5
	9-17-70	14.00	12.0

Base-flow conditions did not prevail during study period.

Time of travel.--Two time-of-travel measurements were made for the upper subreach of Naples Creek in order to define the discharge time relation over a range of flow conditions. One time-of-travel measurement was made on the lower subreach. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Discharge figures for the lower subreach from Parish Flat Road to near the mouth of West River have been deleted from table 1A and 1B because no discharge measurements were made near the mouth of West River. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figure 36. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 37.

Discussion

Time of travel for the first run for the subreaches may be less than normal because of a severe rainstorm in and south of the study area on the morning of September 15, 1970, which increased the flow and probably accelerated the peak time of travel.

Extreme backwater occurs in about 1.5 mi (2.4 km) of the lower part of the subreach from Parish Flat Road to near the mouth of West River as the stream enters the lake.

Canandaigua Outlet

Description of Reach

Canandaigua Outlet starts at the dam of Canandaigua Lake and flows north to north of Shortsville and then swings east. East of Phelps, the stream swings north again to its mouth at Lyons, where it enters the

Erie Canal (fig. 38). Slope of the study reach from United States Highway 20 at Canandaigua to Lyons averages 9 ft/mi (1.7 m/km).

Analysis

Discharge of Canandaigua Outlet was measured at Alloway and obtained from the gaging-station records at Chapin and Flint Creek at Phelps, as follows:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
at Alloway	9-14-70	11.83	57.7

Base-flow conditions prevailed during the two study periods.

A duration curve is presented for the gaging stations in figure 39. The arrows show the approximate duration at which the time-of-travel measurements were made.

Time of travel.--Two time-of-travel measurements were made for Canandaigua Outlet. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 40 to 44. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentrations are shown in figure 45.

Clyde River and Erie Canal

Description of Reach

The Erie Canal starts at the mouth of Tonawanda Creek at the Creek's junction with the Niagara River in western New York. The water from Tonawanda Creek that would normally flow west into the Niagara River during normal streamflows is diverted east by the canal across western and central New York State. During periods of heavy runoff, however, the water may flow into the Niagara River.

The Clyde River is formed by the junction of Canandaigua Outlet and Ganargua Creek at Lock 27 at Lyons, on the Erie Canal.

The Clyde River meanders 20 mi (32 km) through the lowlands from Lyons to the junction with the Seneca River (fig. 46). The river is sluggish and drops only 12 ft (3.7 m) over its length. There are two channels to the river. When the canal was built, a navigation channel was constructed "at grade" in the Clyde River valley. This channel is approximately parallel to the old river channel but deeper and straighter.

The navigation channel is now, for all practical purposes, the actual riverbed; the old riverbed is mainly occupied by stagnant backwater. Two locks and dams have been built on the river, one just southeast of Clyde Village, the other just before the junction with the Seneca River. The old riverbed is used to carry water around the lowest lock, a dam with gates to control flow and elevation.

Analysis

Discharge in the Clyde River and the Erie Canal was measured at State Highway 89 at Clyde. Results are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
State Highway 89	11-14-67	9.87	869

The discharge listed in tables 1A and 1B may be in error because of storage, regulation, and nonbase-flow conditions.

Time of travel.--One time-of-travel measurement was made for the Clyde River and Erie Canal. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 47.

Owasco Inlet

Description of Reach

Owasco Inlet flows generally northwest through Groton, Locke, and Moravia to its mouth at Owasco Lake (fig. 48). Slope of the study reach from Groton to State Highway 38 near Moravia averages 23 ft/mi (4.4 m/km).

Analysis

Discharge in Owasco Inlet was measured at several sites. Results are listed in the table opposite:

Time of travel.--One time-of-travel measurement was made for Owasco Inlet. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative time curves for the time of travel of peak dye concentration are shown in figure 49.

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
State Highway 90 at Locke	7-15-74	15.37	20.8
State Highway 38 near Moravia	7-15-74	13.20	38.0
State Highway 38 near Groton	7-16-74	9.12	12.4

Base-flow conditions prevailed during the study period.

Owasco Outlet

Description of Reach

Owasco Outlet starts at the dam of Owasco Lake and flows to its mouth northwest of Port Byron. The outlet is controlled at the dam by the city of Auburn for its water supply from the lake (fig. 50). Slope of the study reach from Canoga Street at Auburn to mouth near Port Byron averages 15 ft/mi (2.8 m/km).

Analysis

Discharges for Owasco Outlet were obtained from the gaging-station record near Auburn. A duration curve is presented for the gaging station in figure 51. Arrows show the approximate duration at which the time-of-travel measurements were made. Base-flow conditions prevailed during the study period.

Time-of-travel.--Two time-of-travel measurements were made for the Owasco Outlet reach to define the discharge time relation over a range of flow conditions. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 52 to 56. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 57.

Skaneateles Creek

Description of Reach

Skaneateles Creek starts at the dam at the outlet of Skaneateles Lake at Skaneateles (fig. 58). The creek flows generally northwest to its mouth

northwest of Jordan, where it empties into the Erie Canal. Slope of the study reach from Elizabeth Street at Skaneateles to State Highway 31 at Jordan averages 30 ft/mi (5.7 m/km).

Flow in Skaneateles Creek is regulated by the Syracuse City Water Department[1/] (New York State Department of Health, 1955). The city uses Skaneateles Lake water for water supply.

Analysis

The city of Syracuse maintains a Parshall-flume recording gage at Skaneateles Falls that measures the flow in million gallons per day (M gal/d) (0.04 m^3/s).

Discharge in Skaneateles Creek was measured at several sites. Results are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Elizabeth Street at Skaneateles	11-18-70	10.37	3.22
	11-19-70	7.28	6.71
	9-07-71	14.66	10.6
Mottville	11-18-70	13.28	9.13
	11-19-70	15.02	10.1
	9-08-71	11.17	12.2
Long Bridge	9-08-71	12.38	12.0
Gage at Depot Street at Skaneateles Falls maintained by Syracuse Water Department	11-17-70	12.06	20.1
	11-18-70	11.20	13.2
	11-19-70	10.67	13.4
	9-08-71	15.50	9.5
Hamilton Road near Elbridge	11-17-70	10.48	49.1
	11-19-70	8.45	33.3
State Highway 31C near Jordan	11-18-70	14.92	36.2
	9-08-71	13.79	12.4
State Highway 31C at Jordan	11-17-70	14.04	49.8
	11-19-70	16.22	35.3
	9-07-71	11.38	16.0

1/ from Oswego River Drainage Basin Survey Series Report no. 2, Skaneateles Creek Drainage Basin.

Base-flow conditions prevailed during the September 1971 study but not during the November 1970 studies.

Time of travel.--Three time-of-travel measurements were made for selected subreaches to define the discharge-time relation over a range of flow conditions. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 59-61 for selected subreaches. Water-surface profile and cumulative-time curves for the time of travel of the peak dye concentration are shown in figure 62.

Onondaga Lake

Description of Reach

Onondaga Lake starts at the northwest side of Syracuse and flows northwest. The outlet of Onondaga Lake flows into the Seneca River (fig. 63). The lake has a surface area of 4.6 mi^2 (11.9 km^2) and a shoreline of 11.2 mi (18.9 km).

Operational Procedure

A slug of 11.3 gal (42.8 l) of rhodamine WT dye was injected into the lake at the surface-discharge pipe of the Onondaga County Sewage Treatment Plant at the southeast end of the lake.

After the dye injection, traverse lines (fig. 64) were run across the lake by boat with a flow-through-door fluorometer.

Analysis

Mean daily discharges, in cubic feet per second, of three streams entering Onondaga Lake are shown in the following table:

	Stream and gage site		
Date	Onondaga Creek at Syracuse (Spencer Street)	Harbor Brook at Syracuse (Hiawatha Blvd.)	Ninemile Creek at Lakeland
9-14-71	51	8.9	134
9-15-71	50	6.9	120
9-16-71	44	7.7	110

Daily mean gage heights for the lake elevation (Barge Canal datum) were as follows:

Date	Elevation (feet)
9-14-71	4.09
9-15-71	4.12
9-16-71	4.13

Dye dispersion.--Figures 65-67 show the dye concentrations found near the water surface on the traverse runs, and figures 68 and 69 show lines of equal dye concentration 9 hours and 33 hours after injection.

Figure 70 shows the dye concentration of depth samples taken at several points in the lake.

Discussion

The wind was from the northwest and northeast (fig. 71) during the first 9 hours that the dye was in the water, which is probably why the dye stayed along the south shore. Later, the wind blew from the southwest and helped spread the dye toward the northeast shore.

Ninemile Creek

Description of Reach

Ninemile Creek starts at the outlet of Otisco Lake and flows north to Martisco, where it turns northeast and continues into Onondaga Lake (fig. 72). Slope of the study reach from Marcellus to Interstate Highway 690 averages 23 ft/mi (4.4 m/km).

Analysis

Discharge of Ninemile Creek was measured at several sites and obtained from the gaging-station record at Camillus. Results are shown in the table on the following page.

A duration curve is presented for the gaging station in figure 73. Arrows show the approximate duration at which the time-of-travel measurements were made.

Time of travel.--Two time-of-travel measurements were made on Ninemile Creek. Data for injection sites are shown in table 1A; for

sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 74 to 78. Water-surface profile and cumulative-time curves for time of travel of the peak dye concentration are shown in figure 79.

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
State Highway 174 at Marcellus	6-26-73	12.52	49.8
State Highway 174 at Martisco	5-21-73	14.70	195
	6-26-73	13.62	79.6
Dead-end road below Amboy	5-21-73	13.42	249
	6-26-73	9.98	98.4
Interstate Highway 690 at Lakeland	6-27-73	8.91	190

Note: Base-flow conditions did not prevail during the May 21-22, 1973 study but were present during the June 26-27, 1973 study.

Seneca River

Description of Reach

The Seneca River starts at the mouth of Seneca Lake and flows generally northeast through Waterloo, Seneca Falls, and Baldwinsville (fig. 80). At Three Rivers, the Seneca River joins the Oneida River to form the Oswego River.

The Seneca River is canalized (Cayuga-Seneca Canal) for most of its 58.8-mi (94.6-km) length. Slope of the study reach from Seneca Lake to Three Rivers averages 1.4 ft/mi (0.3 m/km). The river has five locks and dams that control its elevation and regulate its flow.

Analysis

Discharges were obtained from the gage record for the gage at Baldwinsville for the 1967 and 1975 studies. Variation in discharge with time at the gaging station for the 1975 study is shown in figure 81. Time of dye injections (I) and time of arrival of peak dye concentrations (P) are noted in figure 81. For the 1971 studies, discharge measurements were made at State Highway 96 at Waterloo on the canal bypass; cross-sections were made on the canal at Waterloo and near Seneca Falls. For the 1975

study, the discharge near Mosquito Point was obtained by using the cross-section area determined by a discharge measurement made on September 23, 1963, at State Highway 38. The velocity obtained from the dye studies was used to compute the discharge by using the area computed from the cross-section measurements. Results of these measurements are shown in the table below.

A duration curve is presented in figure 82 for the gaging station at Seneca River at Baldwinsville. Arrows show the approximate duration at which the time-of-travel measurements were made.

Measurement site	Date	Time of day (decimal time)	Pool elevation (ft)	Average velocity (ft/s)	Discharge (ft^3/s)
		Discharge measurements			
State Highway 96 at Waterloo	8-25-71	15.50	--		113
	10-20-71	09.33	--		5.1
	10-20-71	15.67	--		96
		Cross-section measurements			
Bridge at Evans Chemetrics Co. at Waterloo	8-26-61	--	430.8	[1].11	167
	10-20-71	09.25	430.6	[2].03	45
	10-20-71	14.10	430.7	[2].04	[3]60
State Highway 89 near Seneca Falls	8-25-71	--	383.0	[4].07	104
	10-19-71	07.15	382.8	[2].05	72
	10-19-71	15.55	382.9	[2].07	[3]102
State Highway 38 at Mosquito Point	9-23-63	--	--	[2].32	819

[1] Average velocity of three dye cloud peaks (fig. 93).

[2] Computed from $\frac{\text{distance of peak travel}}{\text{time from injection to arrival of peak (in hours)}} \times 1.467$

[3] May not be valid because of varying velocity due to lockages.

[4] Average of velocity of dye cloud peaks 1-4 and 7 (fig. 92).

Time of travel.--One time-of-travel study was made for the entire reach of the Seneca River in 1967, two studies were made in the vicinity of Waterloo and Seneca Falls in 1971, and one study was made from the Penn Central Railroad near Mosquito Point to Three Rivers in 1975.

Data for injection sites for the 1967 and 1975 studies are shown in table 1A; for sampling sites, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 83-88. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration for the 1967 and 1975 studies are shown in figure 89.

During the 1967 study, the subreach from River Road to Jones Point across Cross Lake was given more analytical treatment than that given the other subreaches. Attempts were made to follow the dye-dispersion cloud and related current patterns across the lake. It was found that the dye stayed in a fairly concentrated mass from the inlet to Buoy 419, a sampling point just north of Little Island. The mass of dye traveled in a relatively straight line that passes just north of Little Island (fig. 90). From this point, the dye was not found again until it had reached Jones Point.

During the 1971 studies, dye was injected both at Evans Chemetrics Co. at Waterloo and at Lock 2 at Seneca Falls after 21.00 hours, (fig. 91), when there would be the least number of lockages. As it turned out, there were no lockages until after 08.00 hours the following day.

After the dye had been in the water for several hours, several sampling traverses were made at different times by boat with a flow-through-door fluorometer to locate the dye.

Results of these traverses are shown as dye concentration plotted against distance below injection site in figures 92 to 95. Figure 96 shows a plot, on an expanded scale, of the distance and time of travel of peak dye concentration from the dye injections made at Lock 2 and Evans Chemetrics Co. during the 1971 studies.

During the October 1971 study, floats with weights attached were dropped from the boat, when the leading edge, peak, and trailing edge of dye were found. Grab-samples were then taken with the pump hose and flow-through-door fluorometer at 2-ft (0.6-m) vertical intervals. The dye concentrations obtained are plotted against depth of water in figures 97 and 98.

Discussion

In figure 92, plots of the dye cloud for runs 5, 6, and 7 do not match the trend of runs 1 through 4. Run 5 was made near the left bank, which indicates that the water may flow more slowly on the left side than in the middle. Run 6 was made near the right bank, which indicates that the water may flow faster on the right side than in the middle. The reason why run 7 plots upstream from run 4 is unknown.

Oneida Creek Basin

Description of Reach

Sconondoa Creek flows west through the study reach from State Highway 234 to Oneida Creek at Oneida. Oneida Creek flows northwest through Oneida to Oneida Lake (fig. 99). Slope of the study reach from Vernon to the mouth of Sconondoa Creek averages 25 ft/mi (4.7 m/km). Slope of the study reach from Oneida to the mouth of Oneida Creek averages 4 ft/mi (0.8 m/km).

Analysis

Discharge in the Oneida Creek basin was measured at Sherill on Sconondoa Creek (following table) and obtained from the gaging-station record for Oneida Creek at Oneida. Results are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Sconondoa Creek at Sherill	8-26-70	14.70	6.14

Base-flow conditions prevailed during the study period.

A duration curve is presented for the gaging station for Oneida Creek at Oneida in figure 100. The arrow shows the approximate duration at which the time-of-travel measurement was made.

Time of travel.--One time-of-travel measurement was made for the Oneida Creek basin. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 101.

Canaseraga Creek Basin

Description of Reach

Canaseraga Creek flows generally north to Oneida Lake (fig. 102). Cowaselon Creek flows north to near Canastota, where it swings northwest and joins Canaseraga Creek 1.5 mi (2.4 km) above the mouth of Canaseraga Creek. Slope of the study reach from State Highway 13 at Canastota on Cowaselon Creek to the mouth of Canaseraga Creek at Lakeport averages 4 ft/mi (0.8 m/km).

Analysis

Discharge in the Canaseraga Creek basin was measured at several sites. Results are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Canastota Creek at North Main Street at Canastota	8-4-71	11.00	2.14
Owlville Creek at New Boston Street at Canastota	8-4-71	10.46	3.49
Canaseraga Creek at Tag Road near Lakeport	8-3-71	9.52	16.0
	8-4-71	8.54	12.0
Cowaselon Creek at Gees Road at Oniontown	8-2-71	16.95	29.6
	8-3-71	15.12	53.4

A rainstorm occurred on the evening of August 2, 1971, therefore, the discharge figure listed on table 1B for the August 3 measurement may be in error.

Time of travel.--One time-of-travel measurement was made for the subreach Gees Road at Oniontown to the mouth at Lakeport. Two time-of-travel measurements were made for the subreach State Highway 13 at Canastota to Gees Road at Oniontown in order to define the relation of discharge to time over a range of flow conditions. Data for injection sites are shown in table 1A; for time-of-travel measurements, in table 1B. Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figure 103. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 104.

Discussion

The automatic sampler did not operate properly so that not enough samples were obtained to define the time-concentration curve fully for the subreach end of Ditch Bank Road to the mouth of Canaseraga Creek. Therefore, no data are listed in tables 1A and 1B for this subreach. However, there was enough information to estimate the peak time-of-travel, as shown in figure 104.

Chittenango Creek Basin

Description of Reach

Chittenango Creek rises 6 mi (9.6 km) northeast of Cazenovia, flows southwest to a point 3.5 mi (5.6 km) south of Cazenovia, where it flows north through Cazenovia and Chittenango to Bolivar Road, then swings west to North Manlius, where it turns north again to Oneida Lake (fig. 105).

Just north of North Manlius, Limestone Creek, which flows generally northward through Fayetteville, enters Chittenango Creek.

Slope of the study reach for Chittenango Creek from Chittenango to the mouth at Oneida Lake averages 2.6 ft/mi (0.5 m/km); slope of the study reach for Limestone Creek from Fayetteville Dam to the mouth near North Manlius averages 2.4 ft/mi (0.5 m/km).

Analysis

Discharge in Chittenango Creek basin was measured at several sites and obtained from the gaging-station record for Limestone Creek at Fayetteville. Results are shown in the following table:

Measurement site	Date	Time of day (decimal time)	Discharge (ft^3/s)
Limestone Creek at North Manlius	9-1-71	14.83	55.4
Chittenango Creek at Chittenango	9-3-70	11.94	22.3
Chittenango Creek at Bridgeport	10-6-70	12.92	140

Base-flow conditions did not prevail when the study was made, August 31 to September 3, 1970. Base-flow prevailed during the study on October 6, 1970.

A duration curve is presented for the gaging station at Limestone Creek at Fayetteville in figure 106. The arrow shows the approximate duration at which the time-of-travel measurement was made.

Time of travel.--One time-of-travel measurement was made for the Chittenango Creek basin. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentrations are shown in figures 107 and 108.

Discussion

In the first time-of-travel run for the subreach Bridgeport to mouth, the dye concentration was too low to give satisfactory results. This subreach was rerun a few weeks later with more dye and produced good results, which are listed in table 1A and 1B.

Oneida River and Erie Canal

Description of Reach

The Oneida River starts at the mouth of Oneida Lake at Brewerton and flows northwest to Caughdenoy. At Caughdenoy, the river turns and flows south to Oak Orchard, where it again turns and flows west to Three Rivers (fig. 109). At Three Rivers, the Oneida River joins the Seneca River to form the Oswego River.

The Oneida River is also a part of the Erie Canal system. About halfway between Brewerton and Caughdenoy, the Erie Canal leaves the river and flows southwest, then rejoins the river between Caughdenoy and Oak Orchard. The only flow in this section of the canal is from lockage and leakage at Lock 23. The river and canal again separate at Horseshoe Island. At this separation, most of the flow goes down the canal and rejoins the river below Horseshoe Island, but some flow remains in the river.

Analysis

Discharge in Oneida River and the Erie Canal was obtained from the gaging-station record at Caughdenoy. A duration curve is presented for the gaging station in figure 110. Arrows show the approximate duration at which the time-of-travel measurements were made. Flow in the river is controlled by gates on the dam at Caughdenoy.

Time of travel.--Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Two studies were made from Brewerton to State Highway 57 at Three Rivers. During the second study, random samples of water were taken at different points in subreaches Brewerton to Caughdenoy and Caughdenoy to Oak Orchard. The time of travel obtained from these samples (figures 111 and 112) was prorated to obtain the time-of-travel for the entire subreaches.

Water-surface profile of the river, in river miles, and the cumulative time of travel of peak dye concentration are shown in figure 113. Cumulative time of travel of the peak dye concentration, in canal miles, via the Erie Canal is shown in figure 114.

Discharge is plotted against time of travel of leading edge, peak, centroid, and trailing edge in figures 115 to 118.

Time of travel of peak dye concentration is plotted against discharge for subreaches Brewerton to Caughdenoy and Caughdenoy to Oak Orchard in figure 119.

Oswego River

Description of Reach

The Oswego River is formed at the confluence of the Oneida and Seneca Rivers at Three Rivers and flows generally northwest, entering Lake Ontario at Oswego (fig. 120). Slope of the study reach from Three Rivers Point to Lock 6, a distance of 22 mi (35.4 km), averages 93 ft/mi (17.6 m/km). The fall is controlled by four dams and locks.

Analysis

Discharge of the Oswego River was obtained from the gaging-station record at Lock 7, Oswego. A duration curve is presented for the gaging station Oswego River at Lock 7, Oswego in figure 121. Arrows show the approximate duration at which the time-of-travel measurement was made. Flow in the Oswego River is controlled by dams on the Seneca River at Baldwinsville and the Oneida River at Caughdenoy and by the four dams on the Oswego River.

Time of travel.--One time-of-travel measurement was made for the Oswego River. Data for injection sites are shown in table 1A; for sampling sites, in table 1B. Water-surface profile and cumulative-time curves for the time of travel of peak dye concentration are shown in figure 122.

SELECTED REFERENCES

Dunn, Bernard, 1964, Time-of-travel study, Fall Creek basin: New York State Dept. Environmental Conserv. Rept. Inv., RI-11, 21 p.

____________ 1975, Time-of-travel study, Lake Erie-Niagara River basins: New York State Dept. Health, open-file rept., 41 p.

G. K. Turner Associates, 1963, Operating and service manual, model III fluorometer: Palo Alto, Calif., 28 p.

Kilpatrick, F. A., Martens, L. A., and Wilson, J. F., Jr., 1970, Measurement of time of travel and dispersion of dye tracing: in U.S. Geological Survey Techniques Water-Resources Inv., book 3, chap. A9, 25 p.

New York State Department of Health, 1955, Oswego River drainage basin survey series report no. 2, Skaneateles Creek drainage basin: New York State Dept. Health, 51 p.

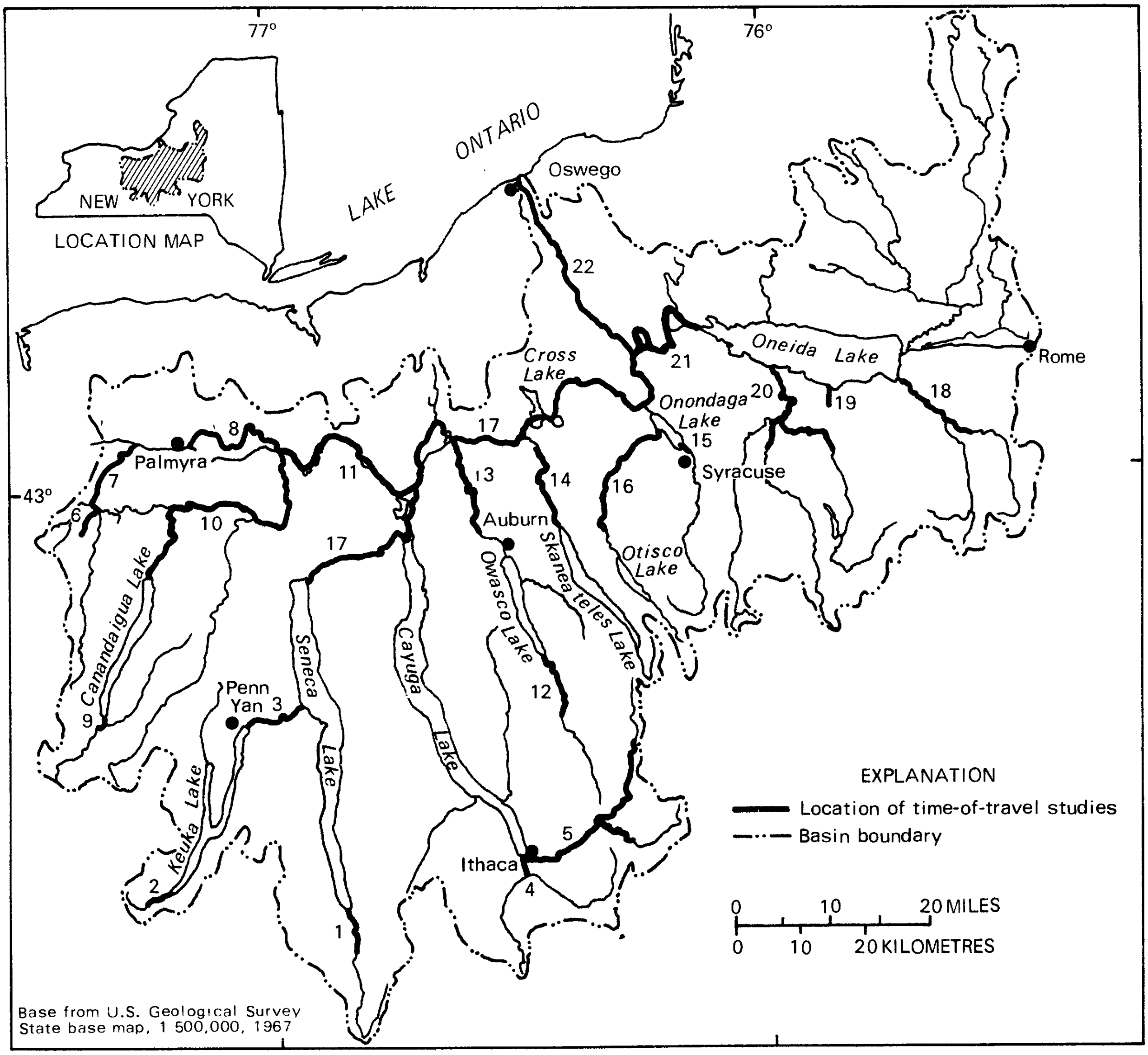
Shindel, H. L., 1969a, Time-of-travel study, Mohawk River, Rome, N.Y. to Cohoes, N.Y.: New York State Water Resources Comm. Rept. Inv., RI-6, 48 p.

____________ 1969b, Time-of-travel study, Upper Hudson River, Fort Edward, N.Y., to Troy Lock and Dam, Troy, N.Y.: New York State Water Resources Comm. Rept. Inv. RI-10, 37 p.

Shindel, H. L., 1973, Time-of-travel study, Batten Kill, from 0.6 mile east of Vermont-New York border to Clarks Mills, N.Y.: New York State Dept. Environmental Conserv., Rept. Inv. RI-12, 18 p.

U.S. Geological Survey, Water resources data for New York, part 1, Surface water records: U.S. Geol. Survey open-file rept., 1967-74 issues (issued annually).

Wilson, J. F., Jr., 1967, Fluorometric procedures for dye tracing: in U.S. Geol. Survey Techniques Water-Resources Inv., book 3, chap. A12, 31 p.



Number on map	Stream or Lake	Figure
1	Catharine Creek	3
2	Keuka Inlet basin	5
3	Keuka Lake Outlet	8
4	Cayuga Inlet	14
5	Fall Creek basin	23
6	Fish Creek	26
7	Ganargua Creek (above Erie Canal)	28
8	Ganargua Creek (below Erie Canal)	29
9	West River basin (Naples Creek)	35
10	Canandaigua Outlet	38
11	Clyde River and Erie Canal	46
12	Owasco Inlet	48
13	Owasco Outlet	50
14	Skaneateles Creek	58
15	Onondaga Lake	63
16	Ninemile Creek	72
17	Seneca River	80
18	Oneida Creek basin	99
19	Canaseraga Creek basin	102
20	Chittenango Creek basin	105
21	Oneida River and Erie Canal	109
22	Oswego River	120

Figure 1.--Location of reaches studied in the Oswego River basin.

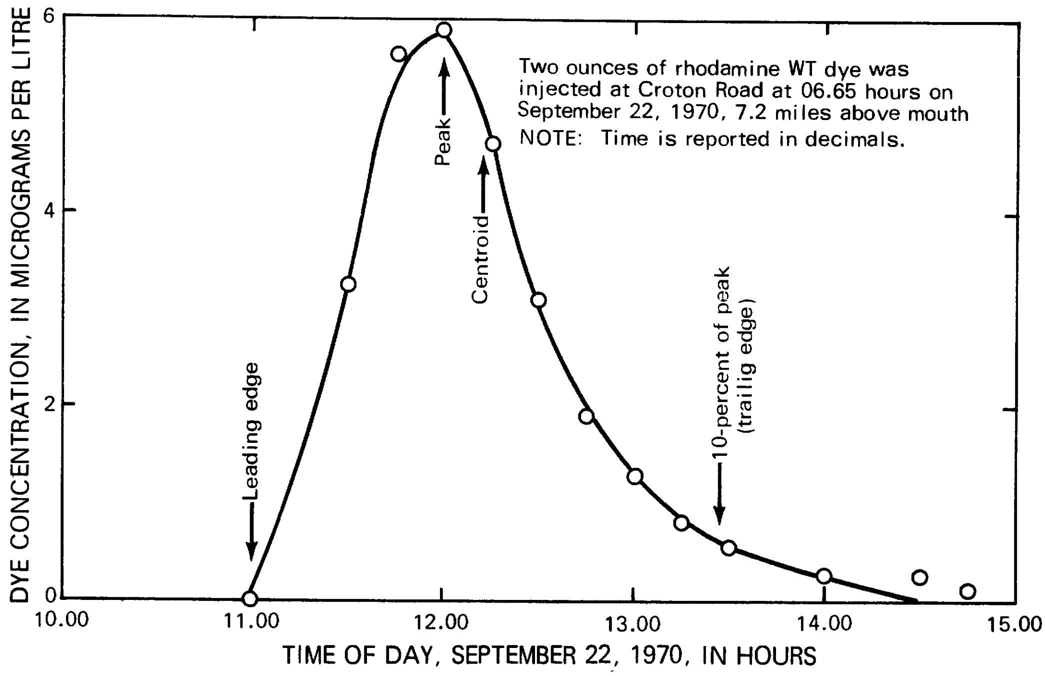


Figure 2.--Variation in concentration of dye with time for Catharine Creek at South Genesee Road, 4.5 mi (7.2 km) upstream from mouth.

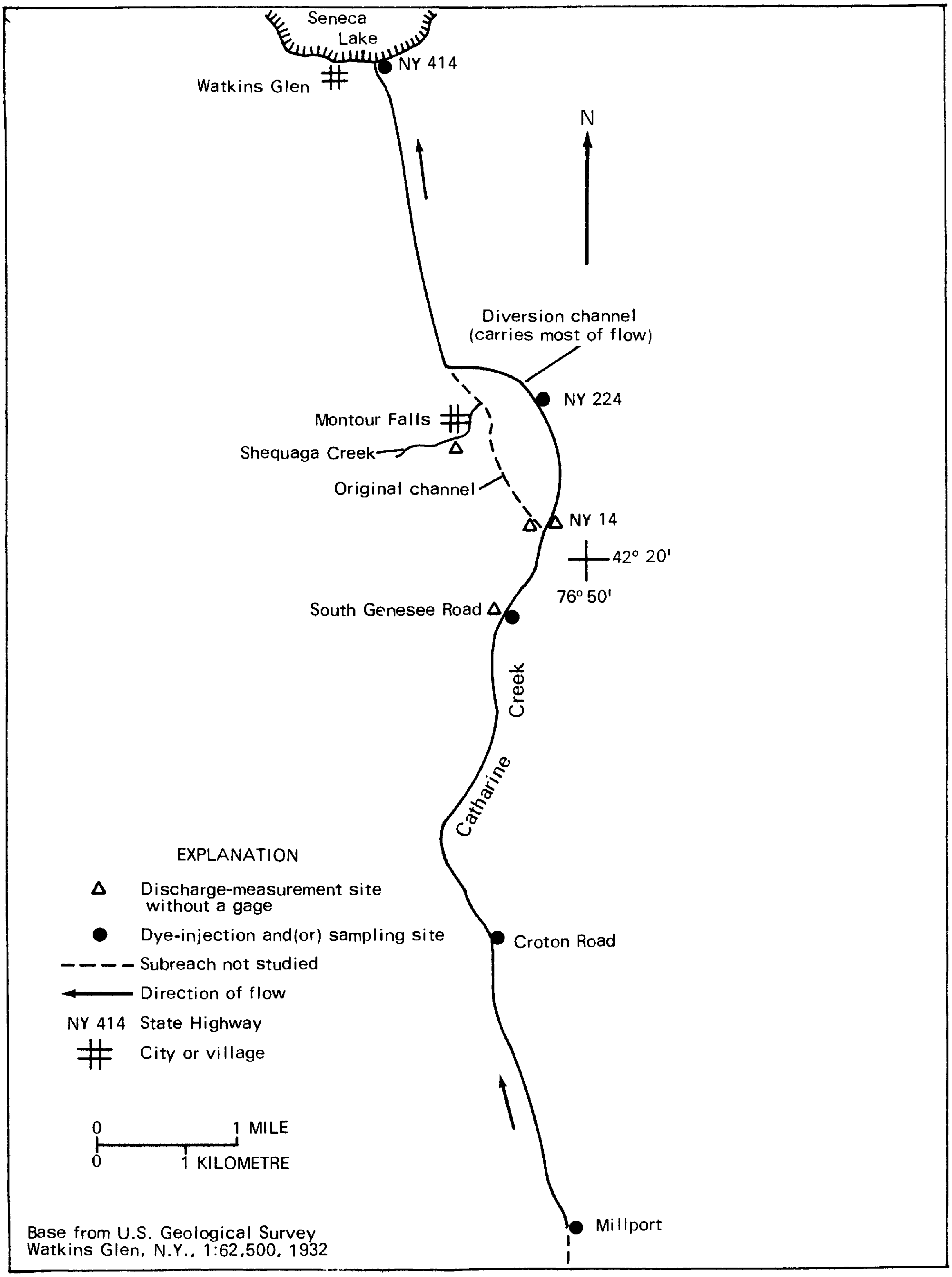


Figure 3.--Location of reach, subreaches, and measurement sites in Catharine Creek basin.

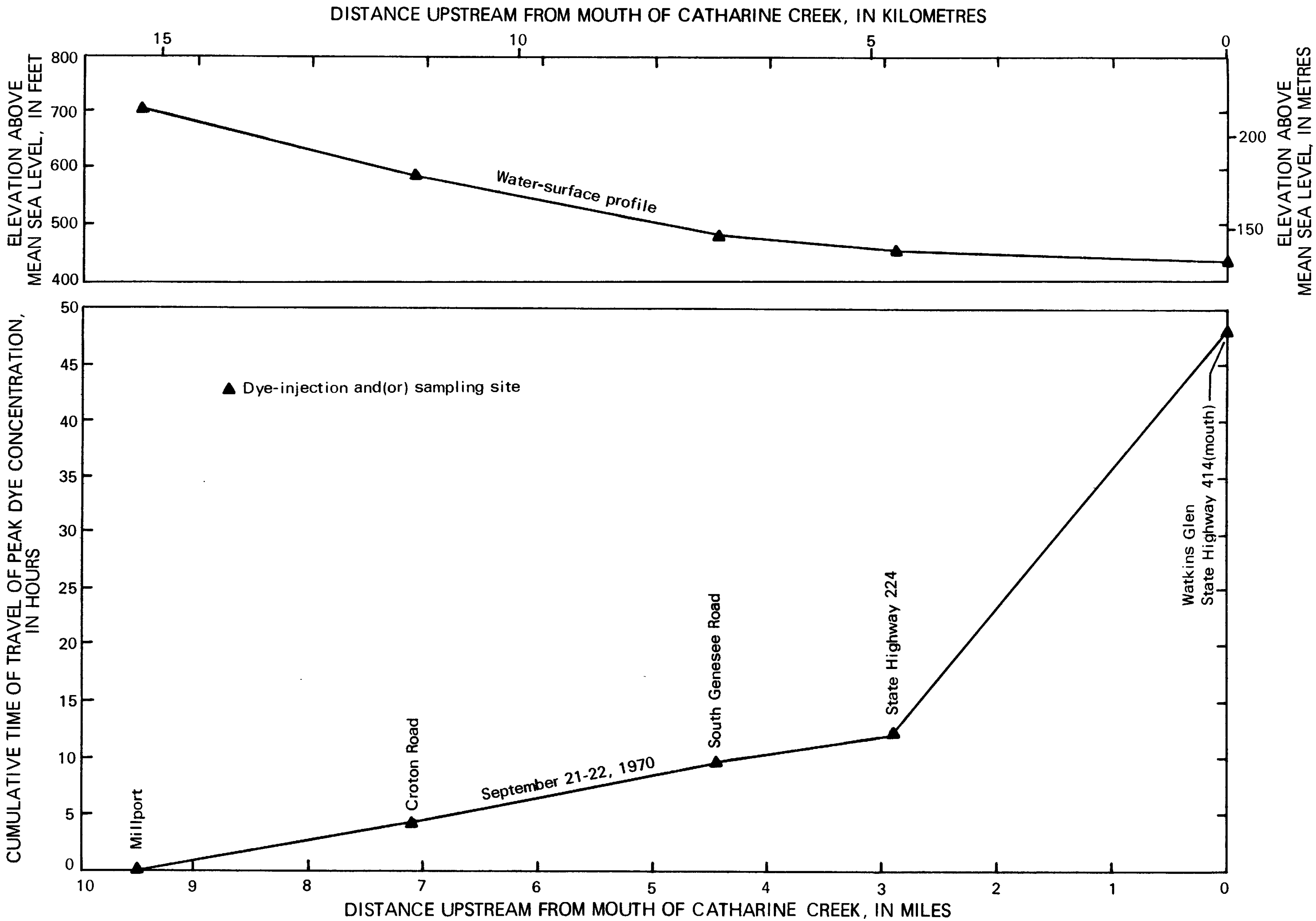


Figure 4.--Water-surface profile and cumulative time of travel of peak dye concentration for Catherine Creek: Millport to State Highway 414 at Watkins Glen.

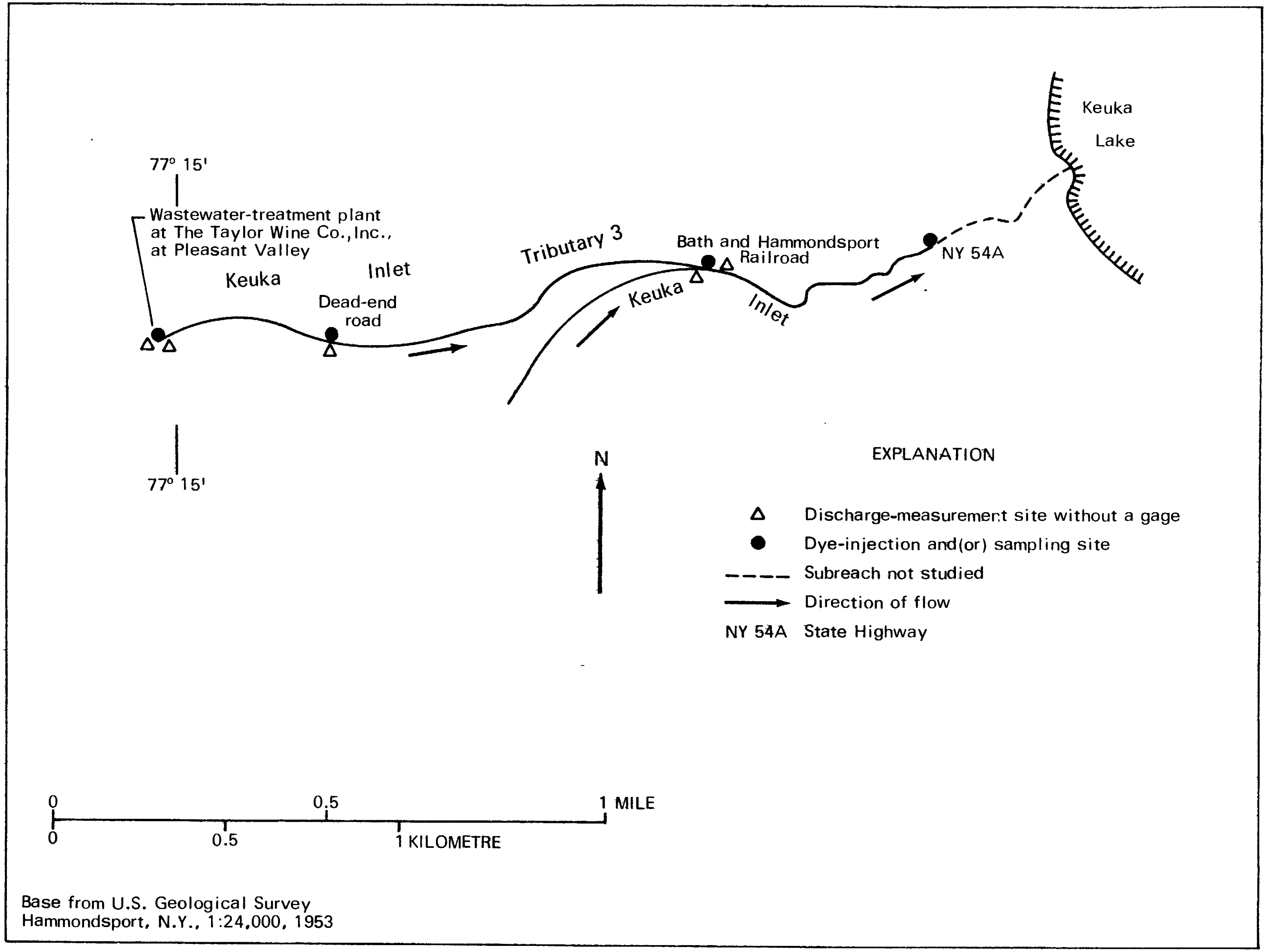


Figure 5.--Location of reaches, subreaches, and measuring sites in Keuka Inlet basin.

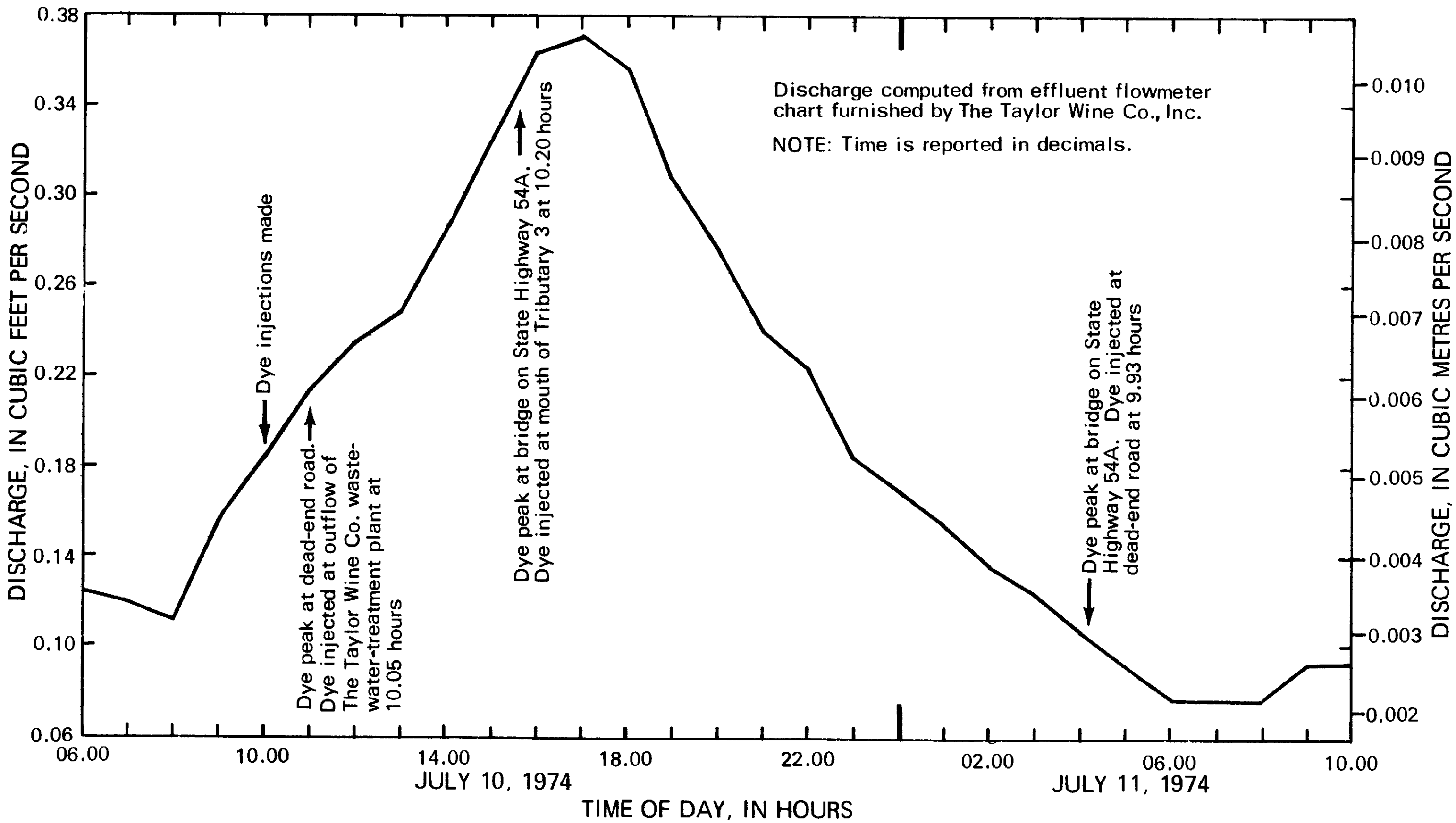


Figure 6.--Variation in discharge with time at wastewater-treatment plant of The Taylor Wine Co., Inc., for Keuka Inlet Tributary 3 at Pleasant Valley.

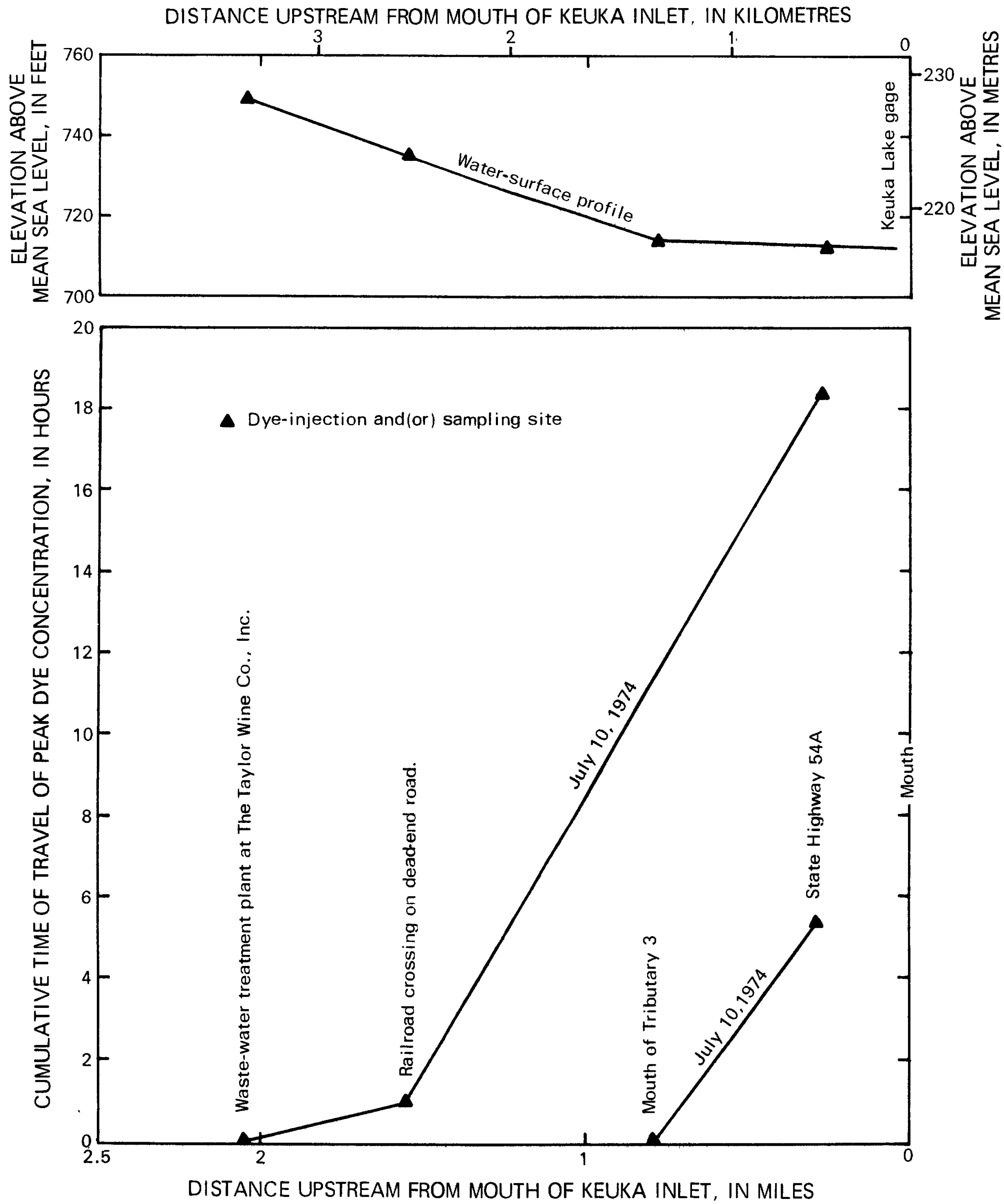


Figure 7.--Water-surface profile and cumulative time of travel of peak dye concentration from wastewater-treatment plant of The Taylor Wine Co., Inc., Pleasant Valley, for Keuka Inlet Tributary 3 to State Highway 54A crossing Keuka Inlet at Hammondsport.

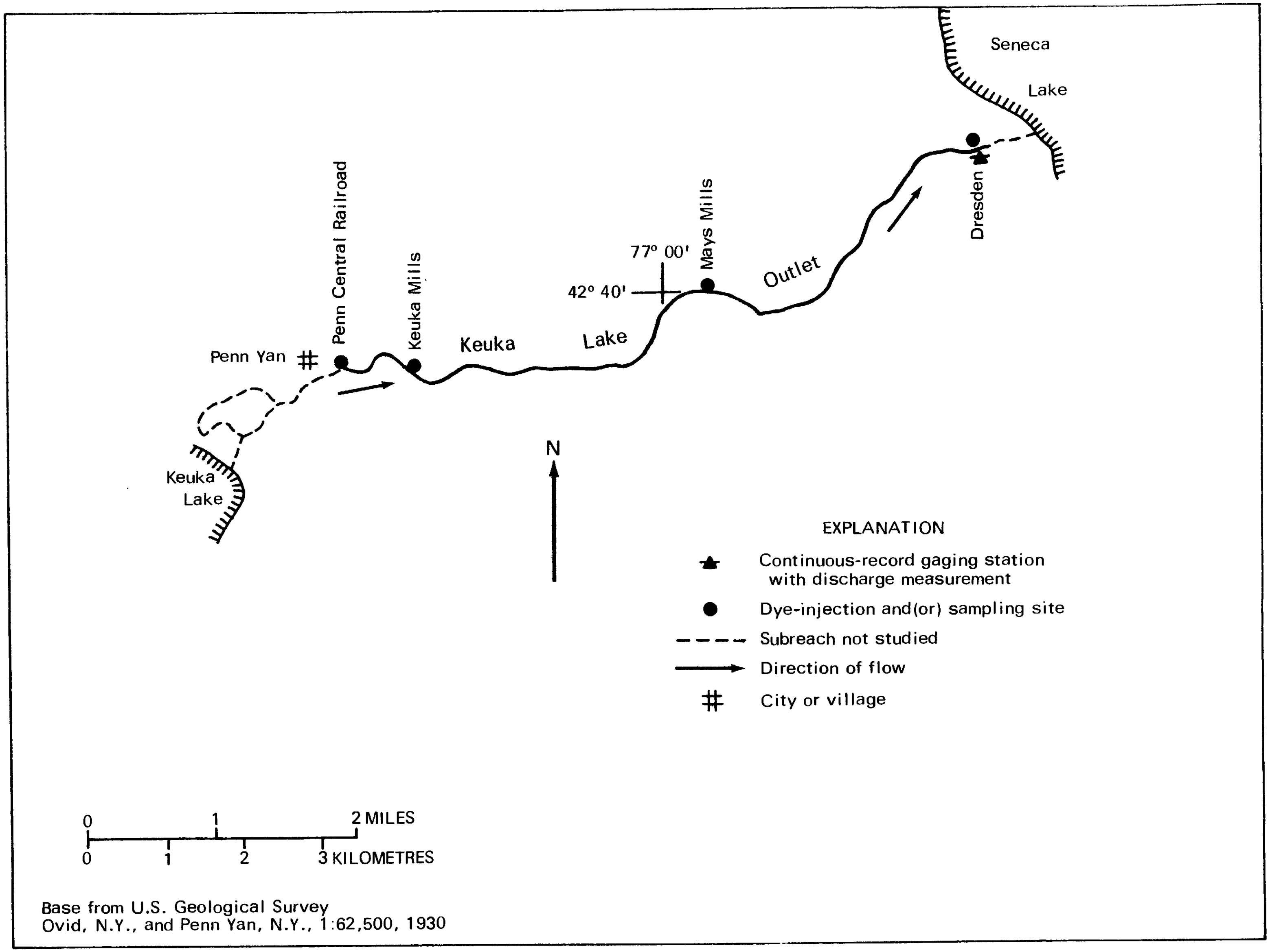


Figure 8.--Location of reach, subreaches, gaging station, and measurement site on Keuka Lake Outlet.

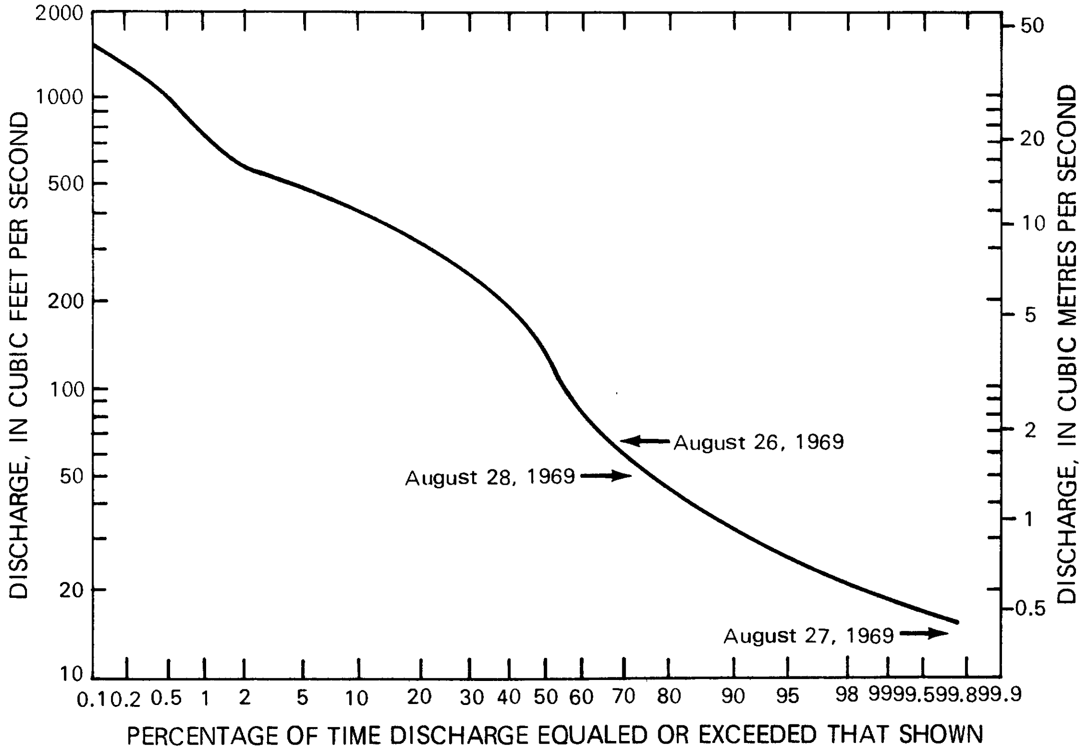


Figure 9.--Duration curve of daily mean flows for Keuka Lake Outlet at Dresden.

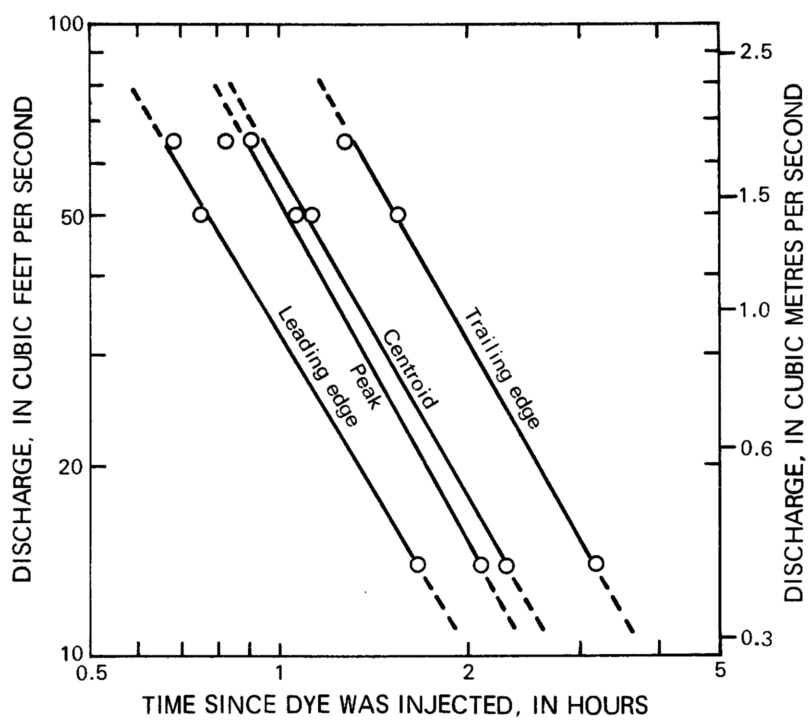


Figure 10.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Keuka Lake Outlet: Penn Yan to Keuka Mills.

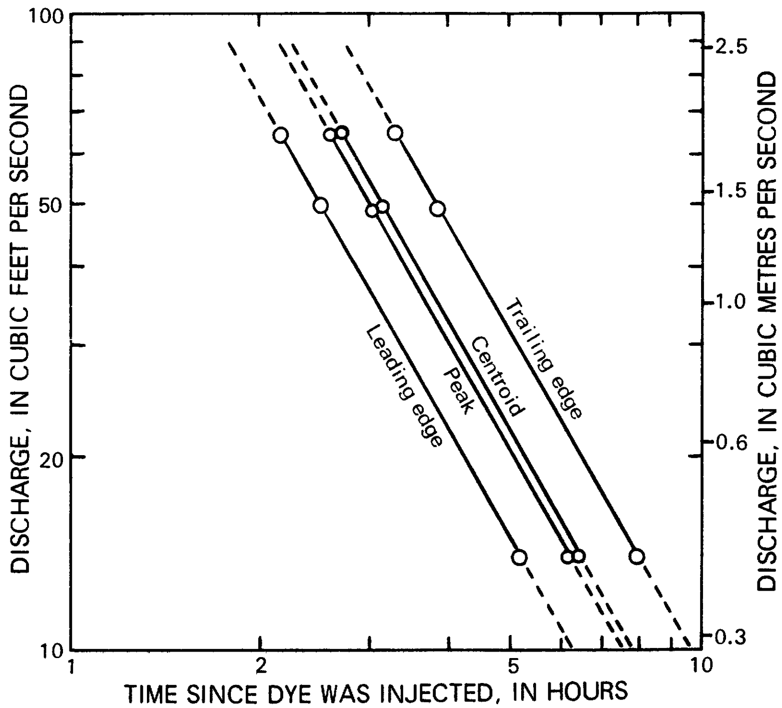


Figure 11.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Keuka Lake Outlet: Keuka Mills to Mays Mills.

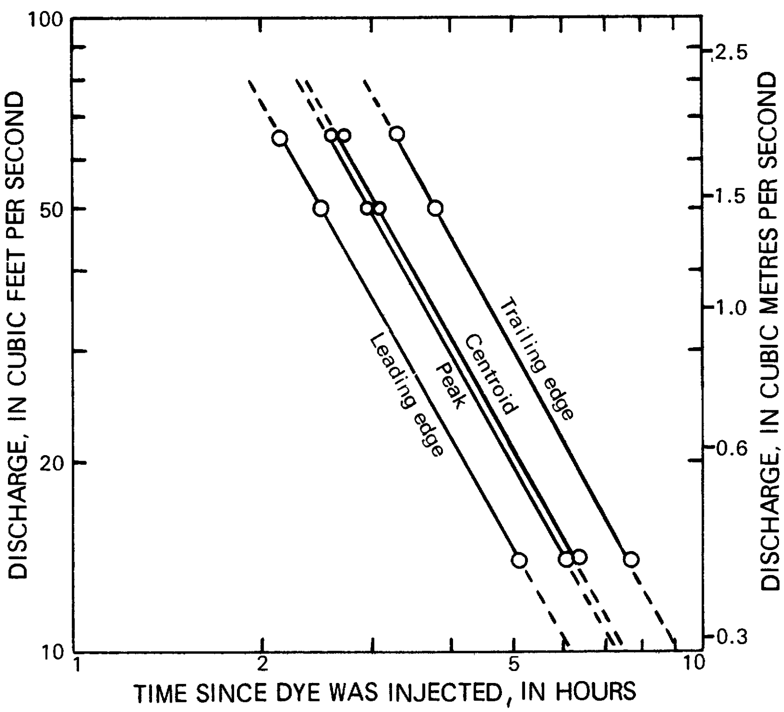


Figure 12.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Keuka Lake Outlet: Mays Mills to Dresden.

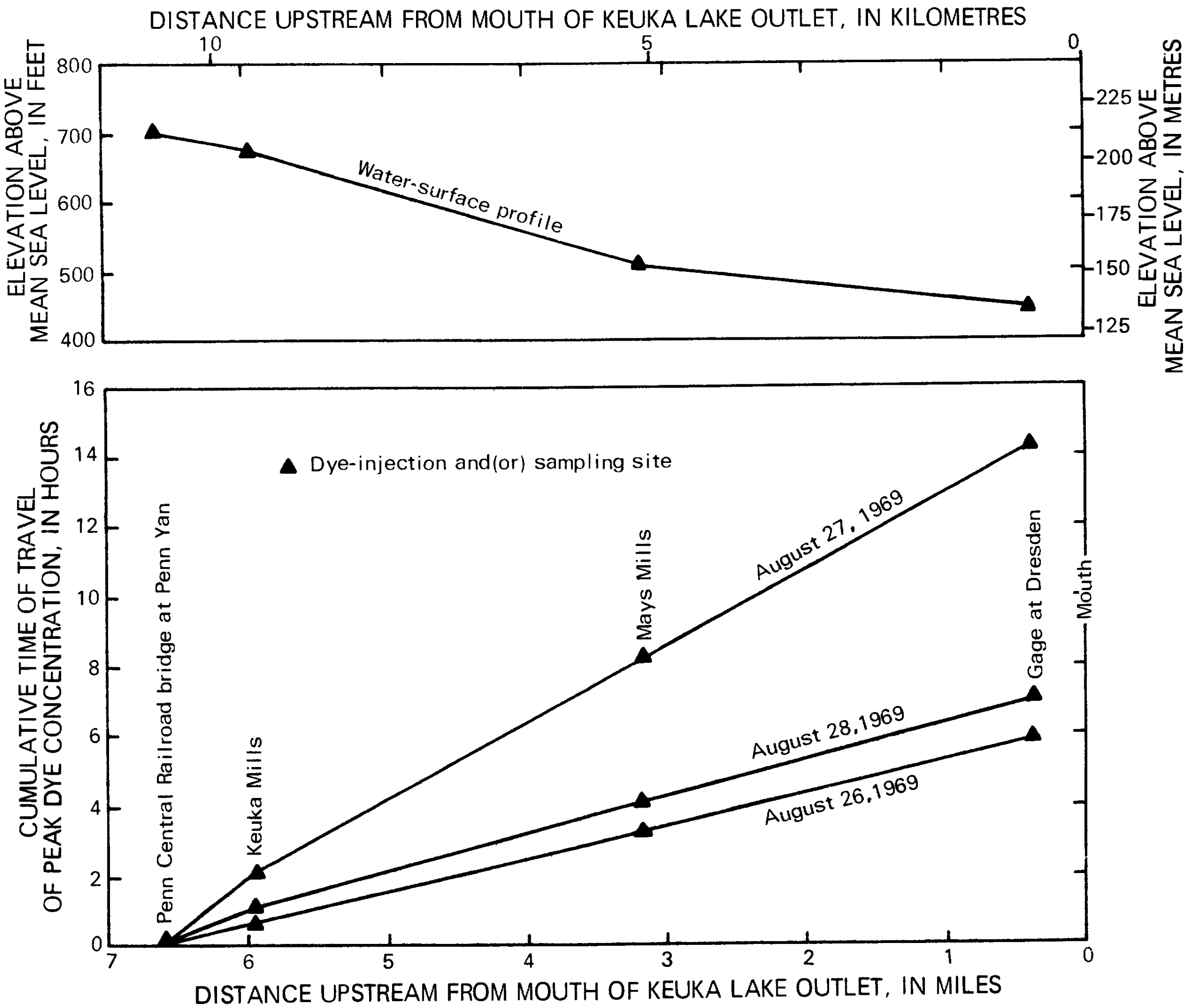


Figure 13.--Water-surface profile and cumulative time of travel of peak dye concentrations for Keuka Lake Outlet: Penn Yan to Dresden.

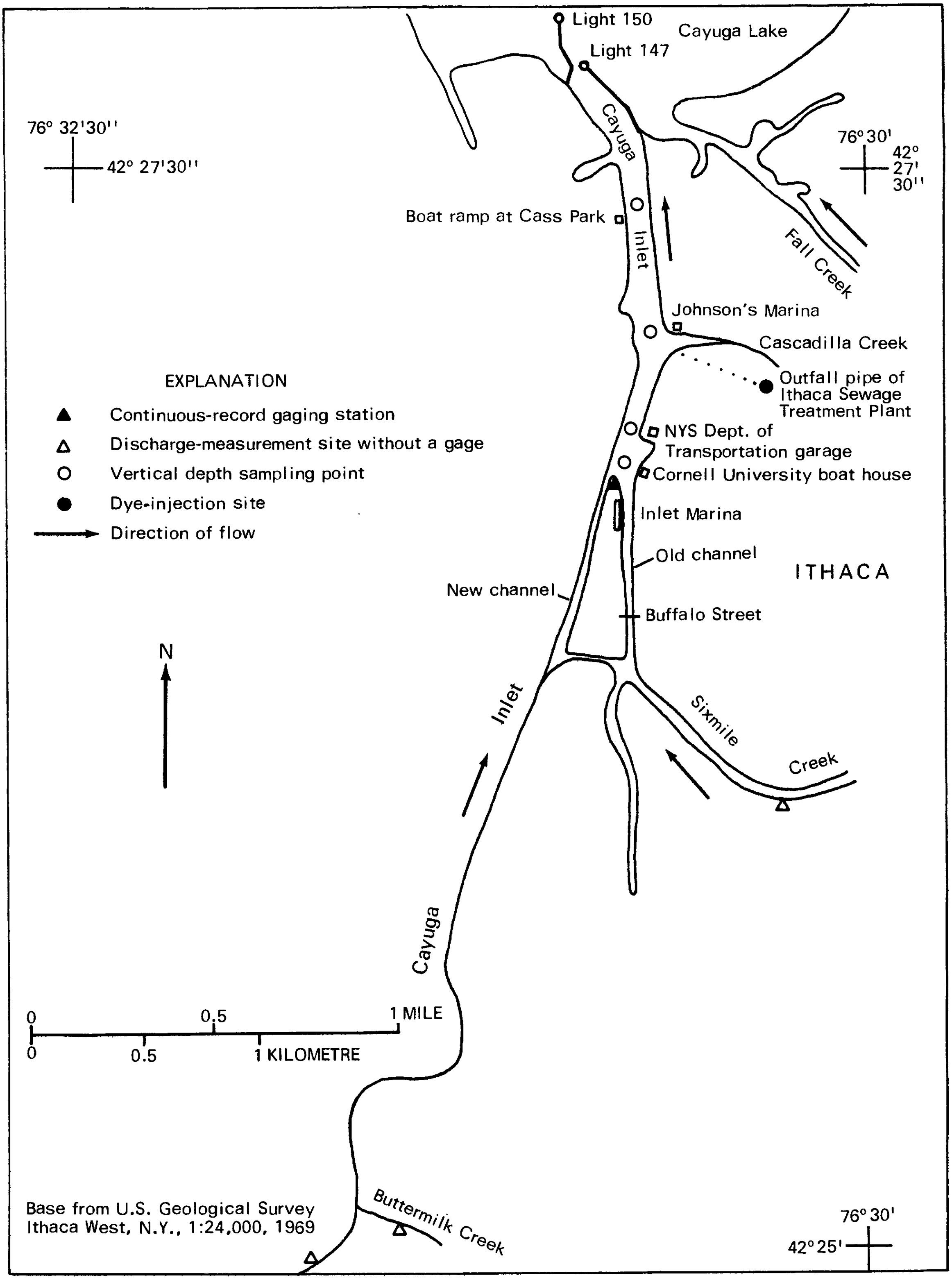


Figure 14.--Location of study area for Cayuga Inlet at Ithaca.

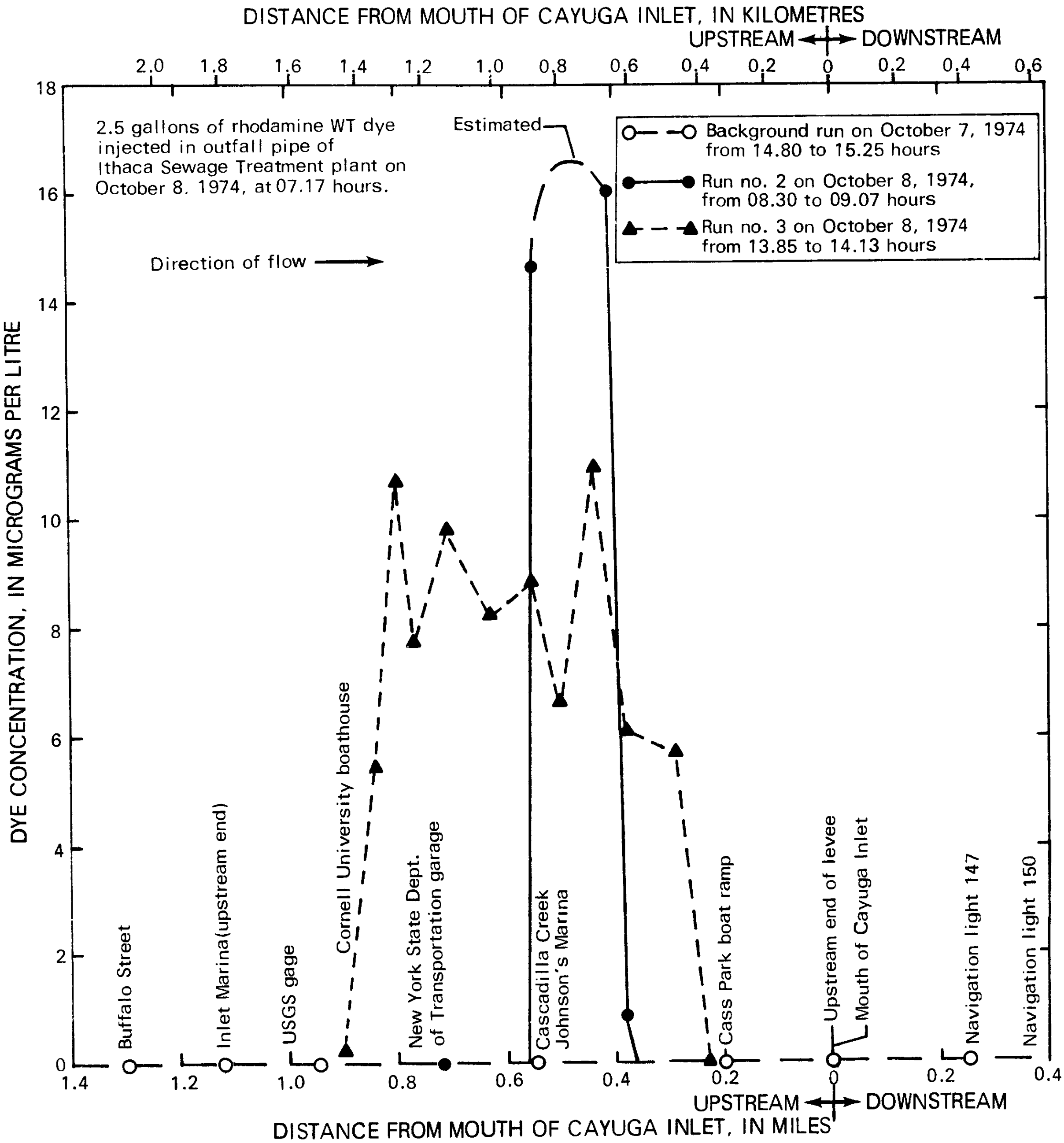


Figure 15.--Relation of dye concentration to distance for Cayuga Inlet, October 8, 1974.

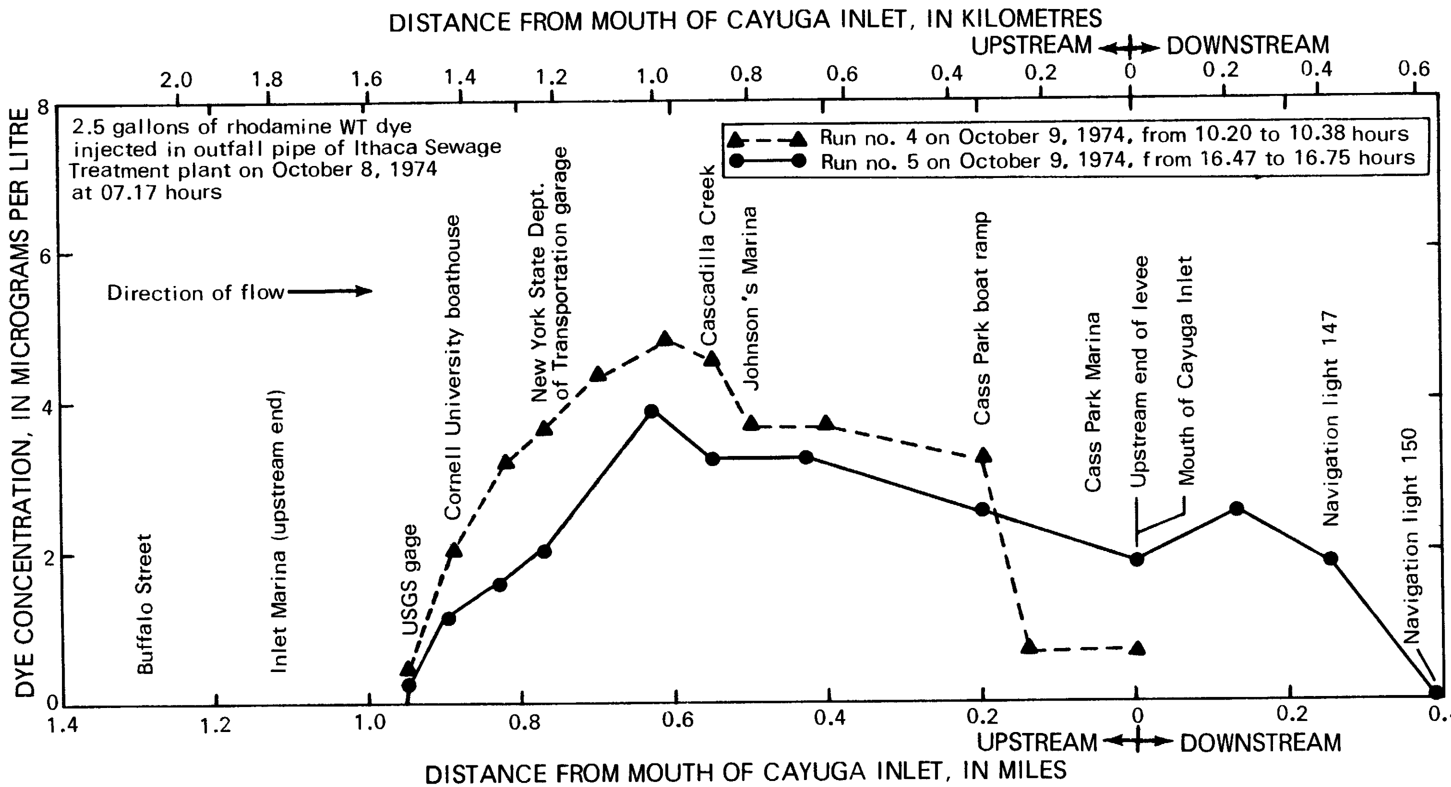


Figure 16.--Relation of dye concentration to distance for Cayuga Inlet, October 9, 1974.

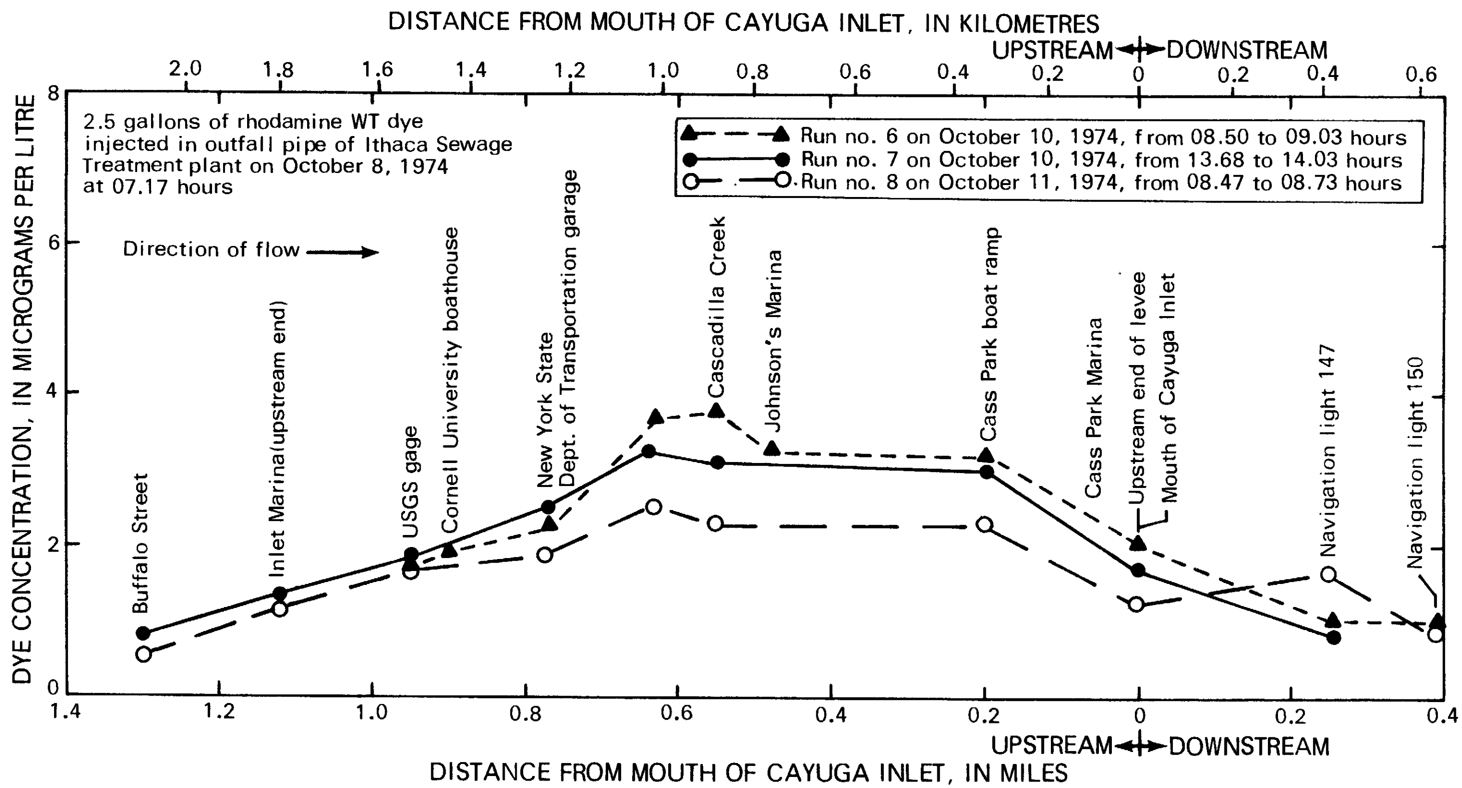


Figure 17.--Relation of dye concentration to distance for Cayuga Inlet, October 10-11, 1974.

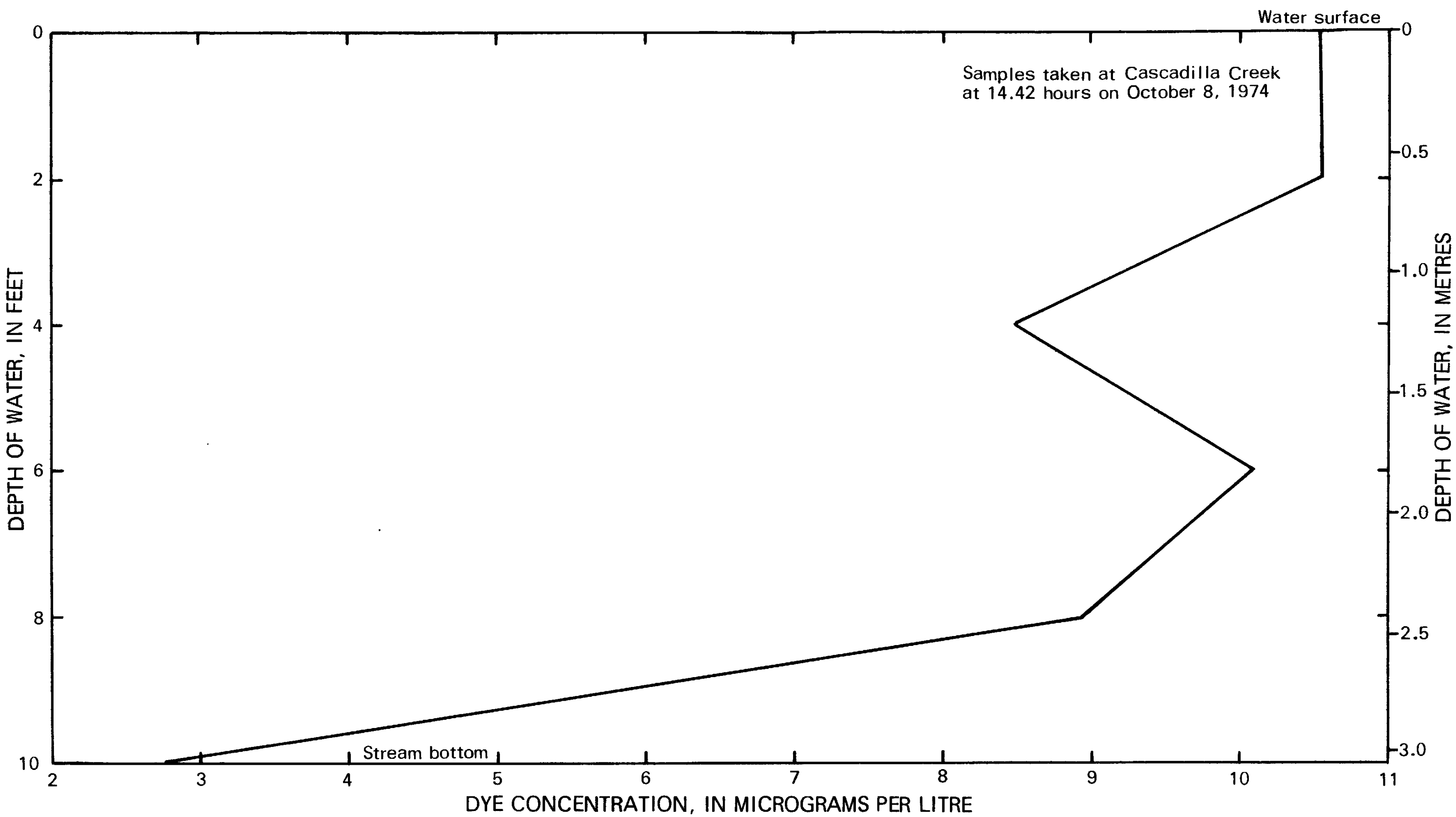


Figure 18.--Relation of depth of water to dye concentration for Cayuga Inlet at Cascadilla Creek at 14.42 hours, October 8, 1974.

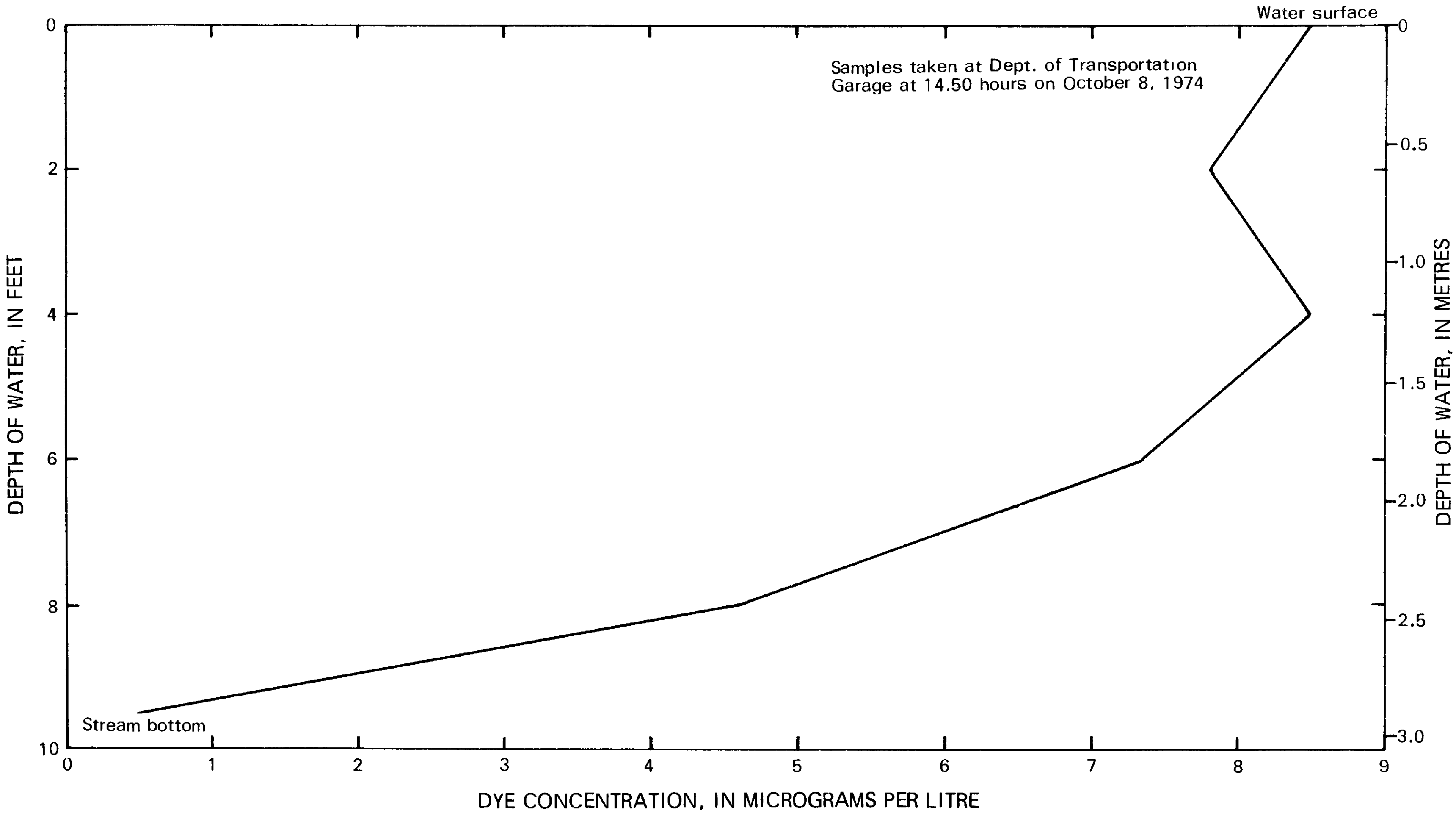


Figure 19.--Relation of depth of water to dye concentration for Cayuga Inlet at New York State Department of Transportation garage at 14.50 hours, October 8, 1974.

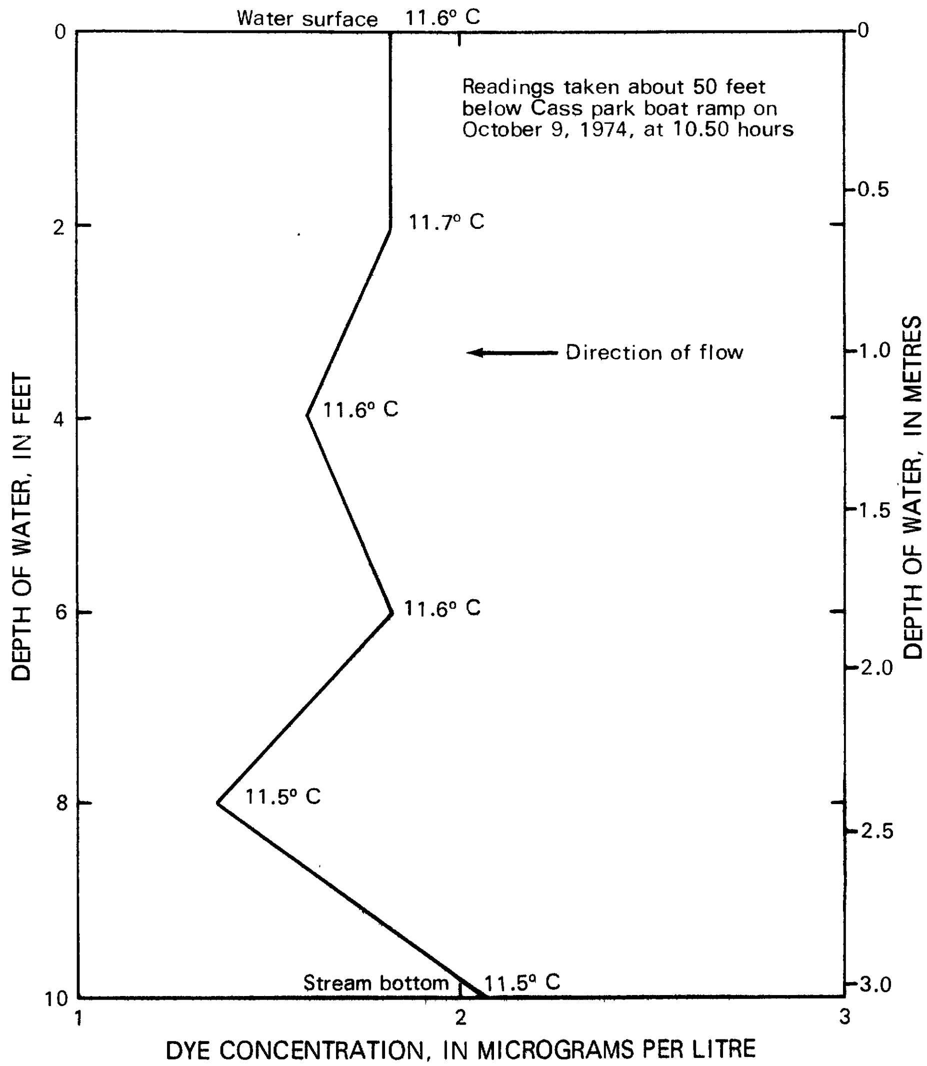


Figure 20.--Relation of depth of water to dye concentration for Cayuga Inlet about 50 ft (15.2 m) downstream from Cass Park boat ramp at 10.50 hours, October 9, 1974.

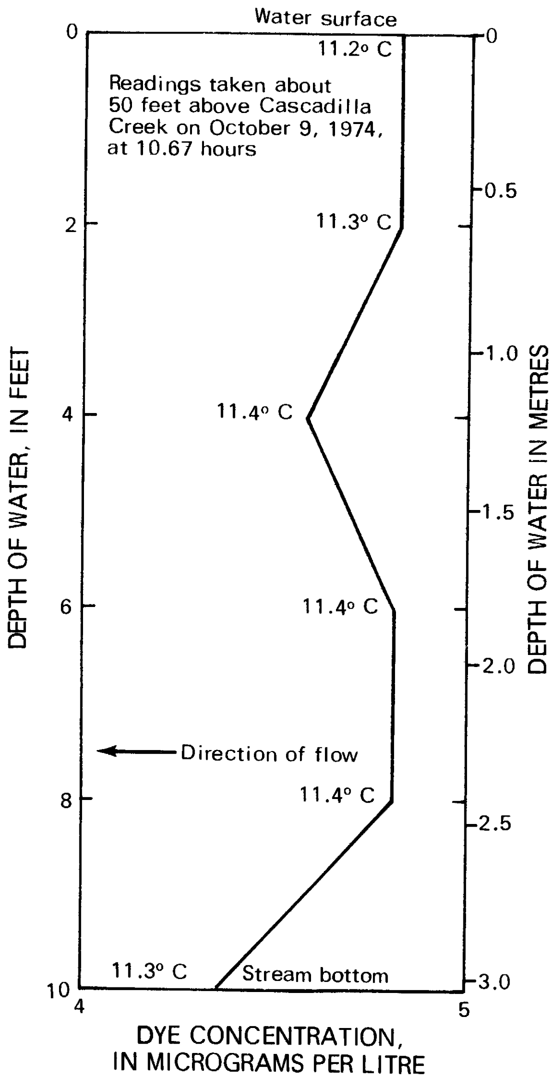


Figure 21.--Relation of depth of water to dye concentration for Cayuga Inlet about 50 ft (15.2 m) upstream from Cascadilla Creek at 10.67 hours, October 9, 1974.

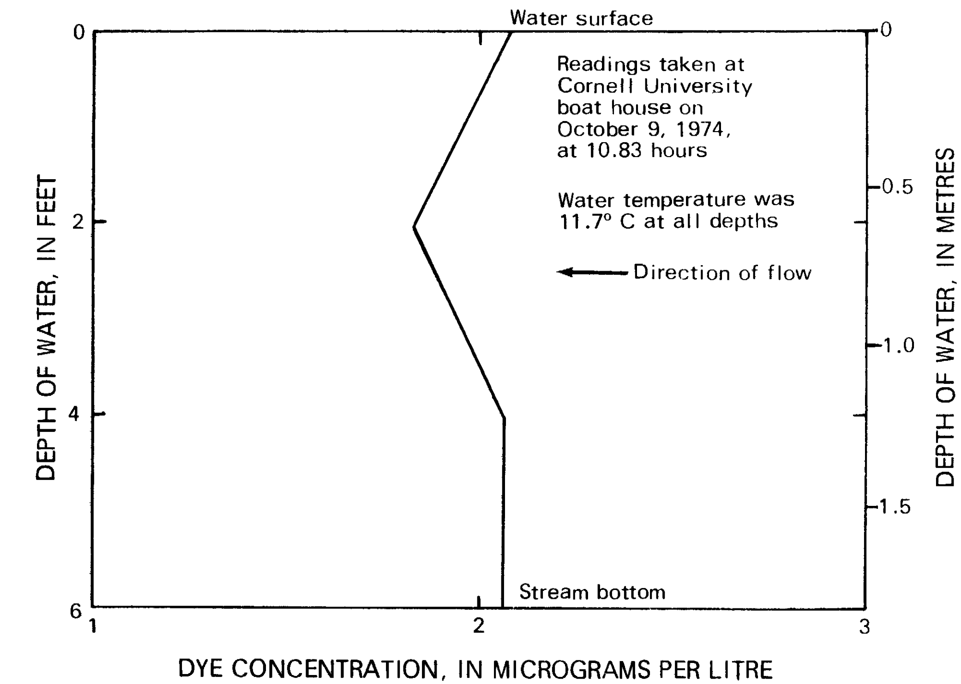


Figure 22.--Relation of depth of water to dye concentration for Cayuga Inlet at Cornell University boathouse at 10.83 hours, October 9, 1974.

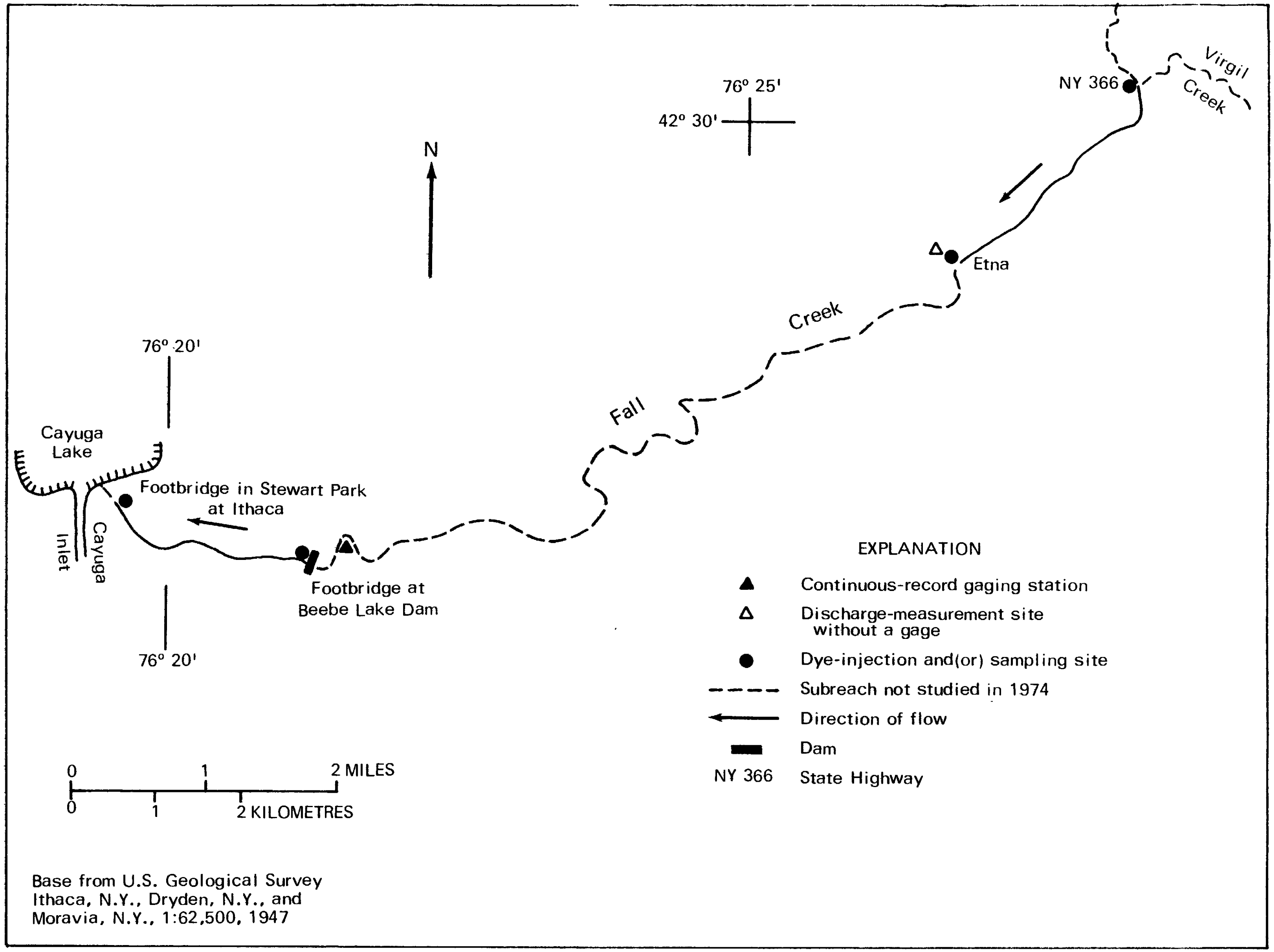


Figure 23.--Location of reach, subreaches, gaging station, and measurement sites on Fall Creek.

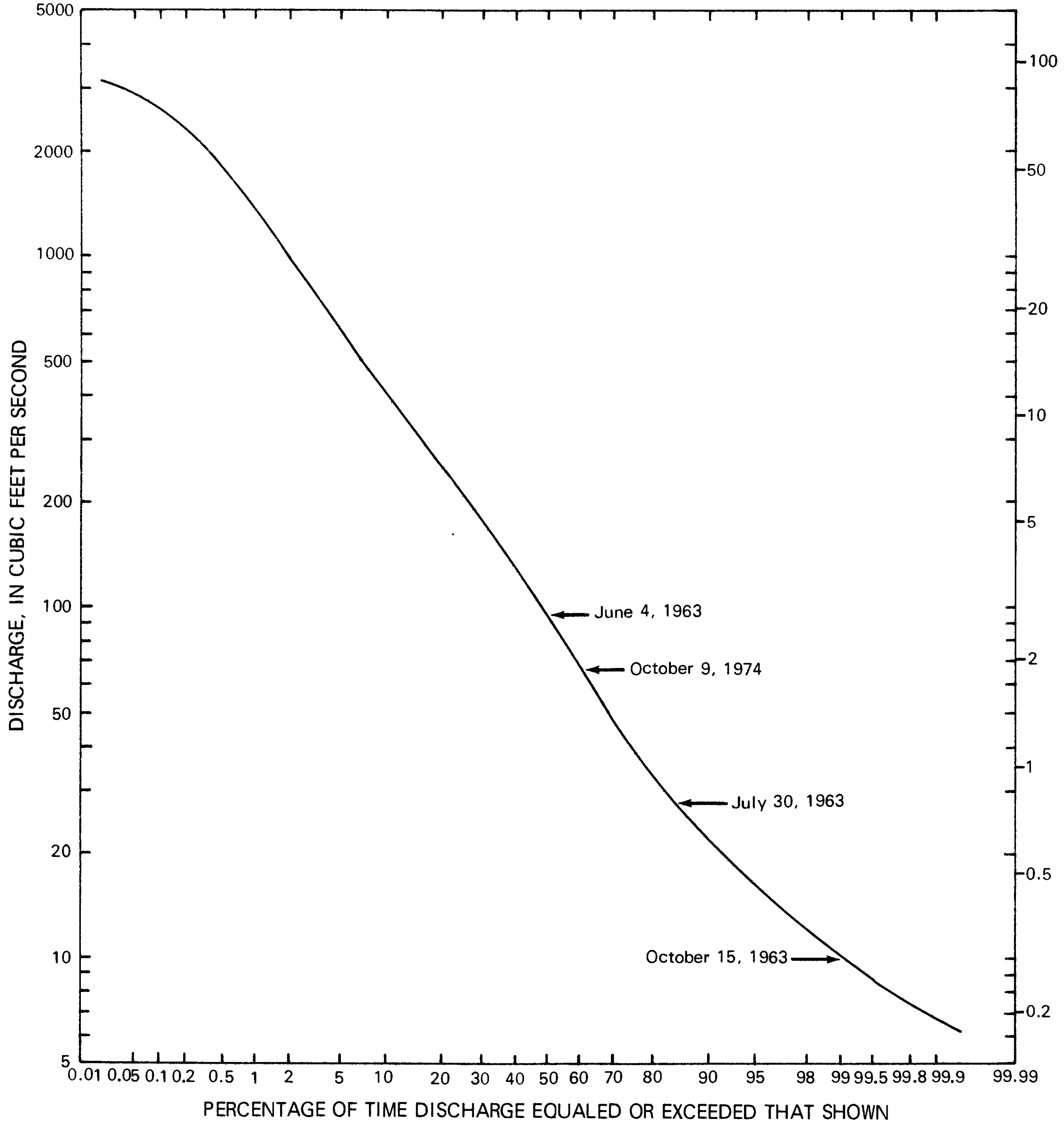


Figure 24.--Duration curve of daily mean flows for Fall Creek near Ithaca.

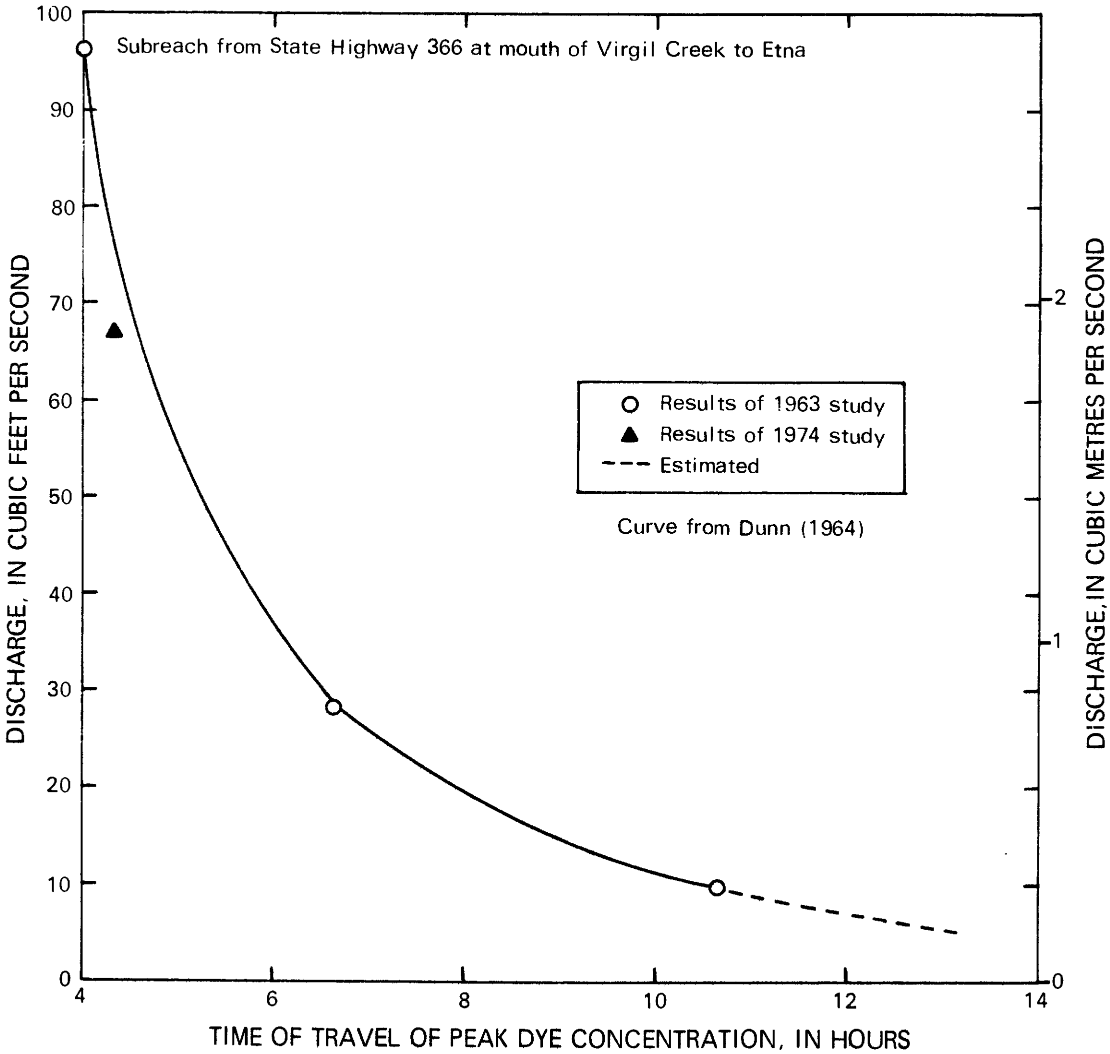


Figure 25.--Relation of discharge to time of travel of peak dye concentration for Fall Creek: State Highway 366 at mouth of Virgil Creek to Etna.

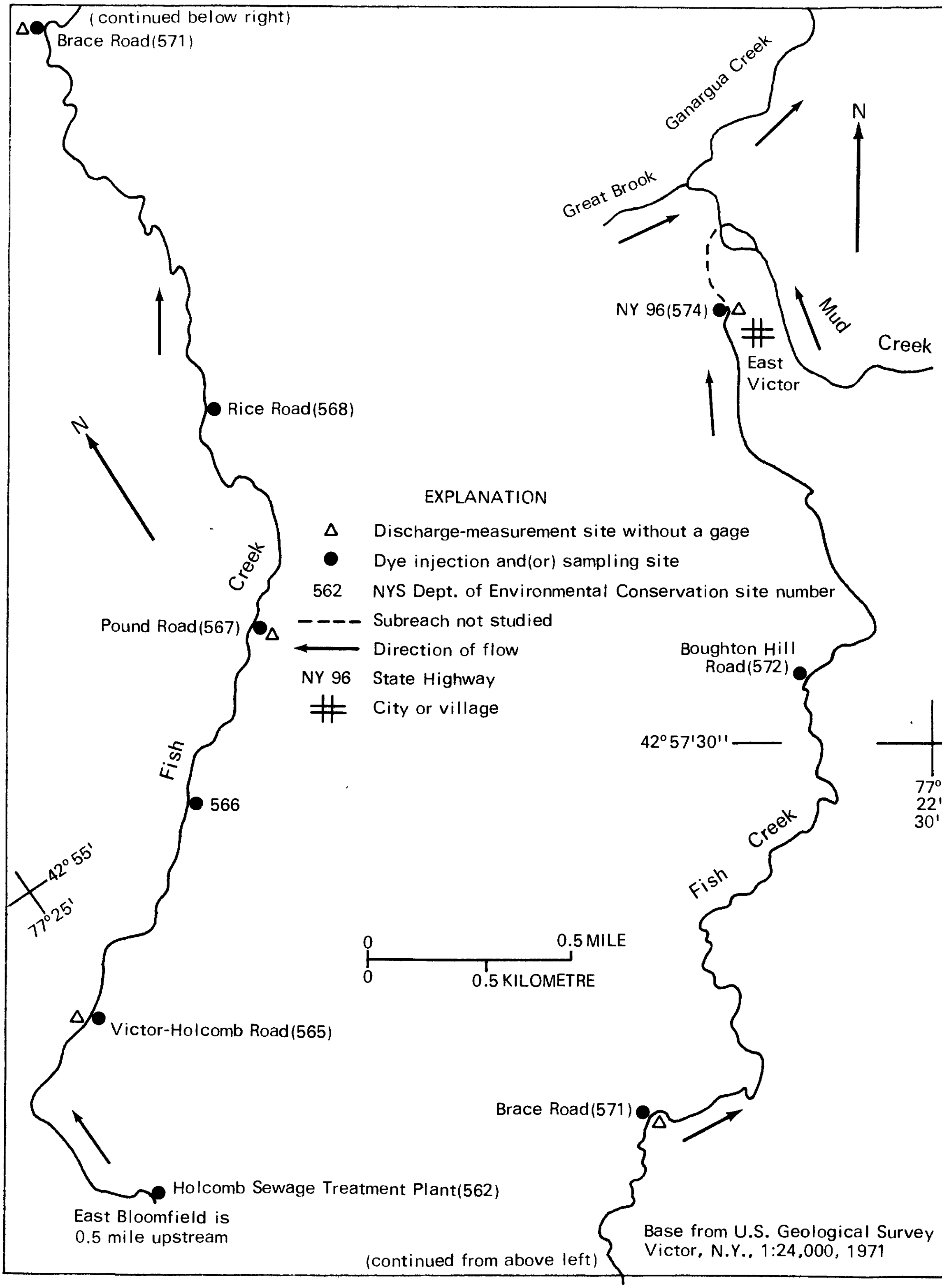


Figure 26.--Location of study reach, subreaches, and measurement sites on Fish Creek.

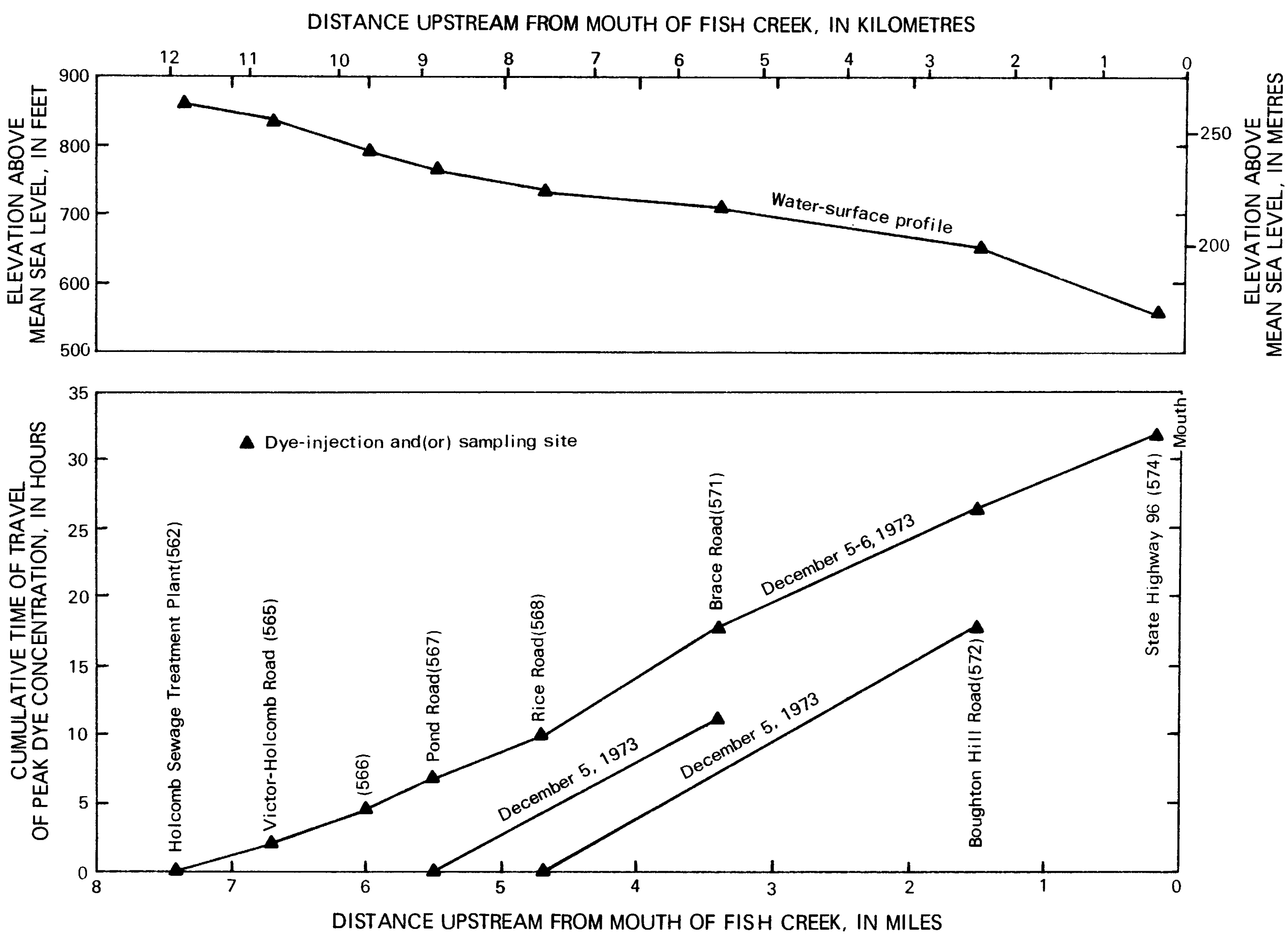


Figure 27.--Water-surface profile and cumulative time of travel of peak dye concentration for Fish Creek: East Bloomfield-Holcomb Sewage Treatment Plant to East Victor. Numbers in parentheses are site numbers assigned by New York State Department of Environmental Conservation.

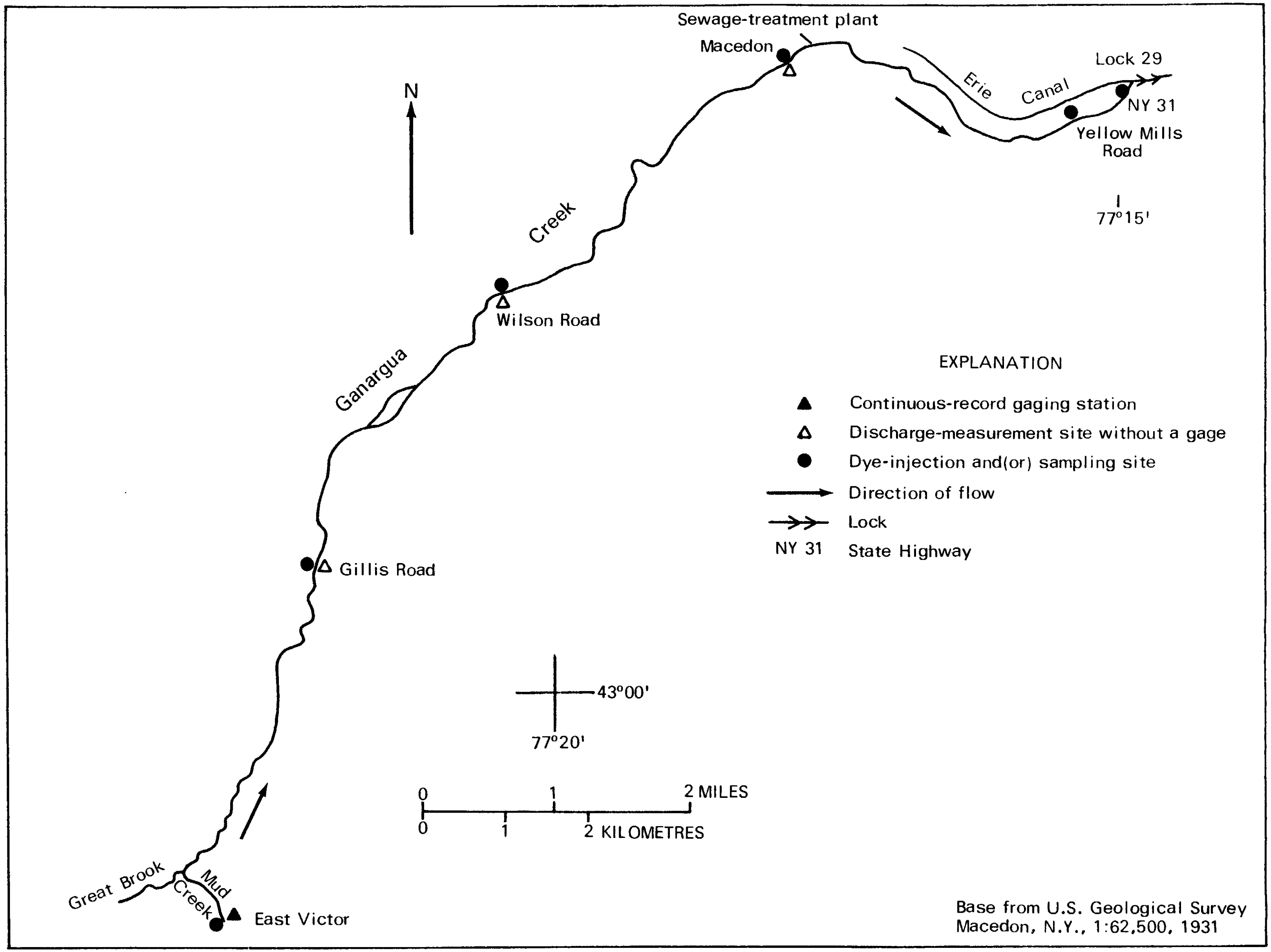


Figure 28.--Location of reach, subreaches, gaging station, and measurement sites in Ganargua Creek basin from East Victor to Yellow Mills.

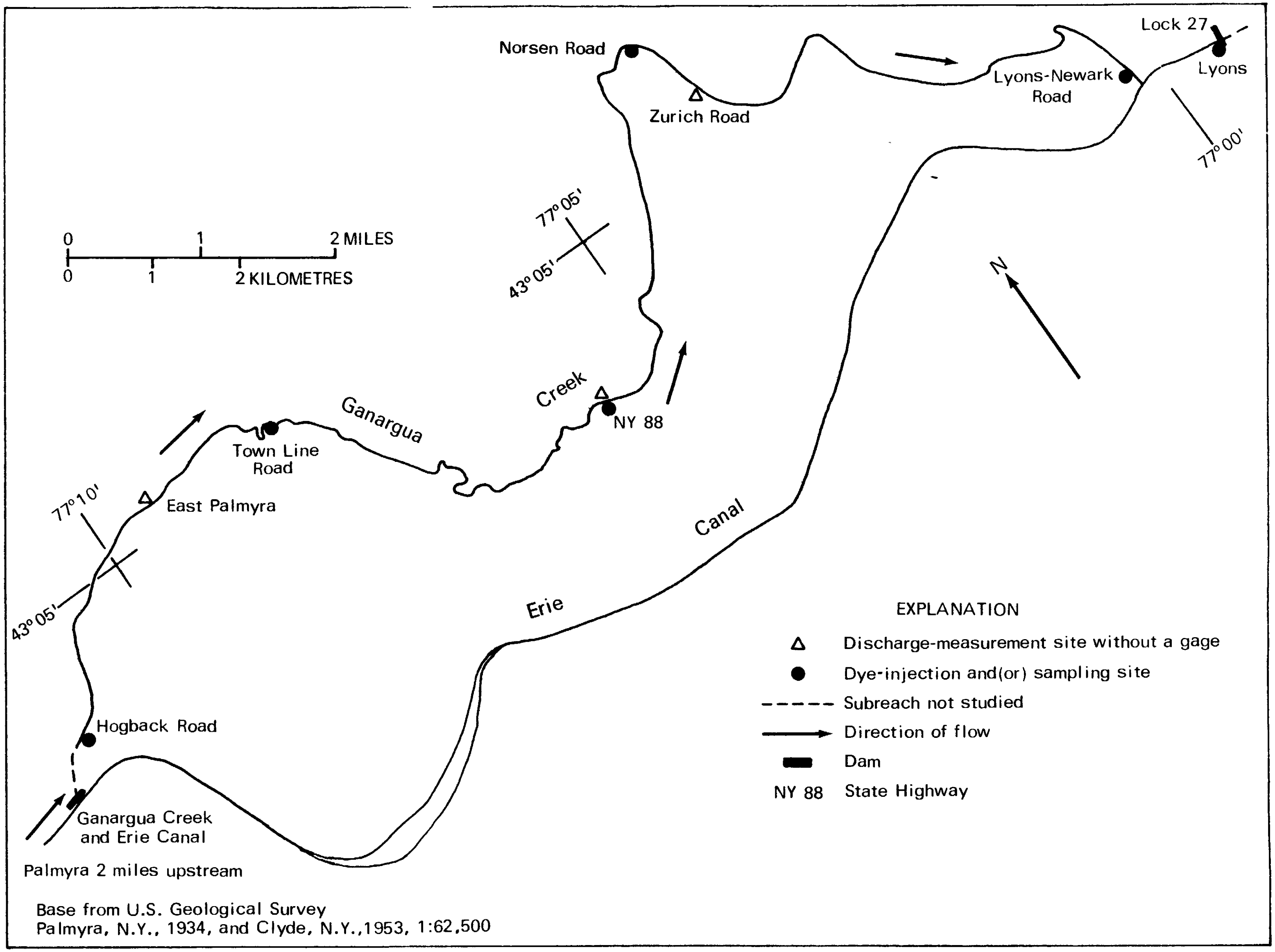


Figure 29.--Location of reach, subreaches, and measurement sites in Ganargua Creek basin from Hogback Road near Palmyra to Lock 27 on Erie Canal at Lyons.

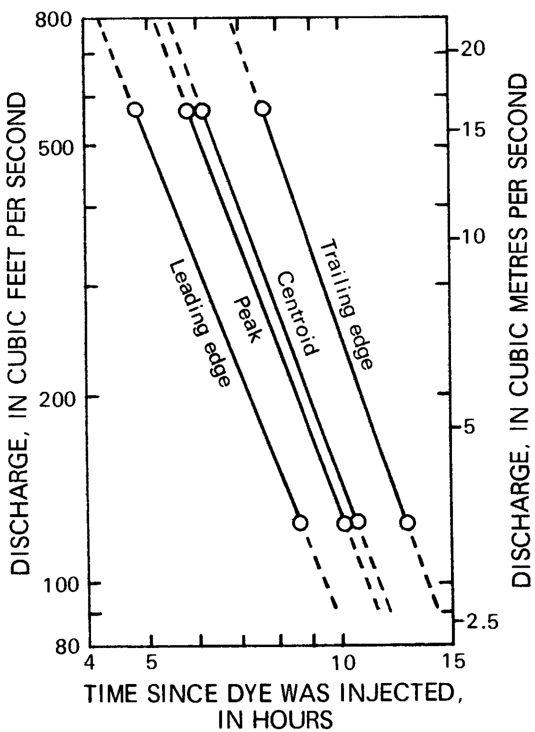


Figure 30.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ganargua Creek from Town Line Road to State Highway 88.

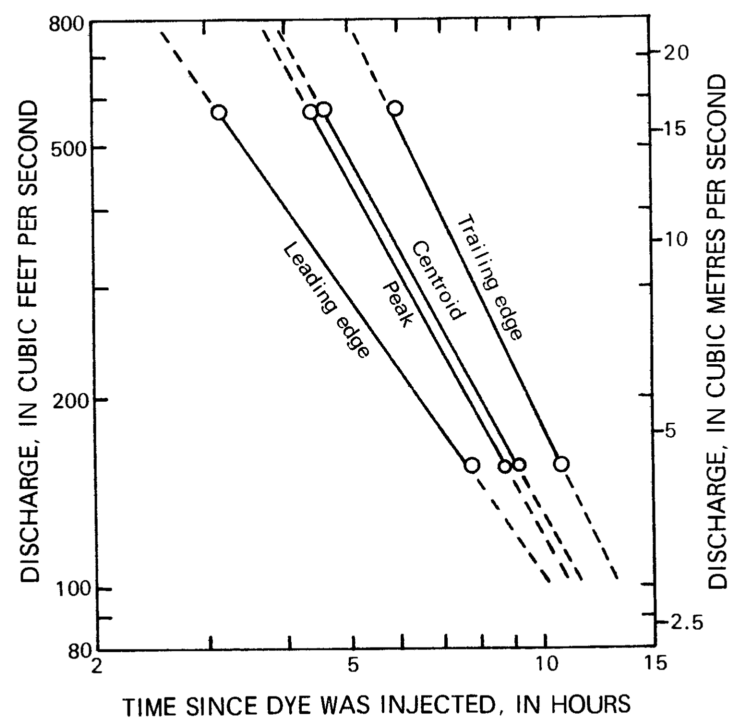


Figure 31.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ganargua Creek from State Highway 88 to Norsen Road.

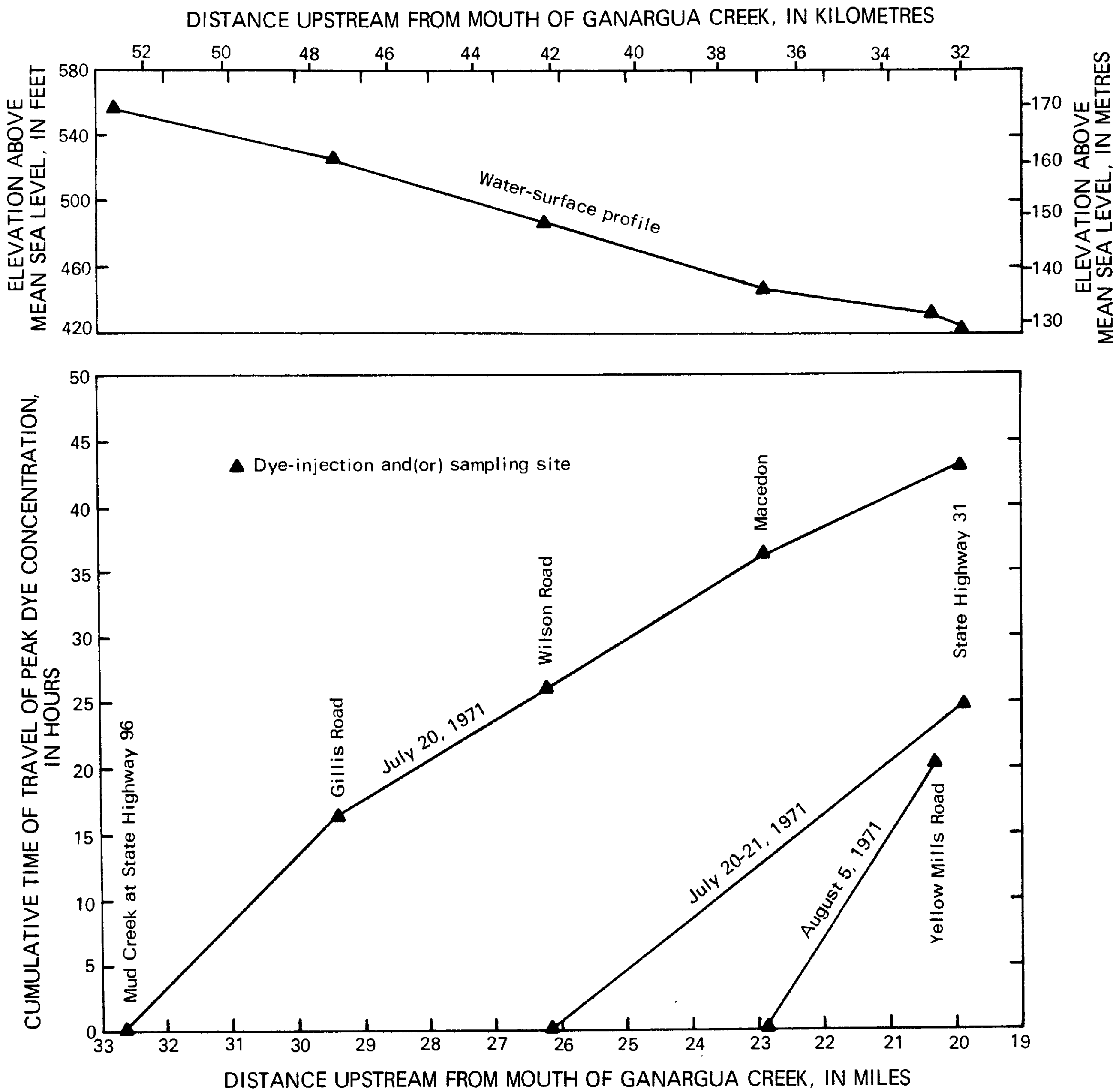


Figure 32.--Water-surface profile and cumulative time of travel of peak dye concentration for Ganargua Creek basin: Mud Creek at East Victor to Ganargua Creek at Yellow Mills.

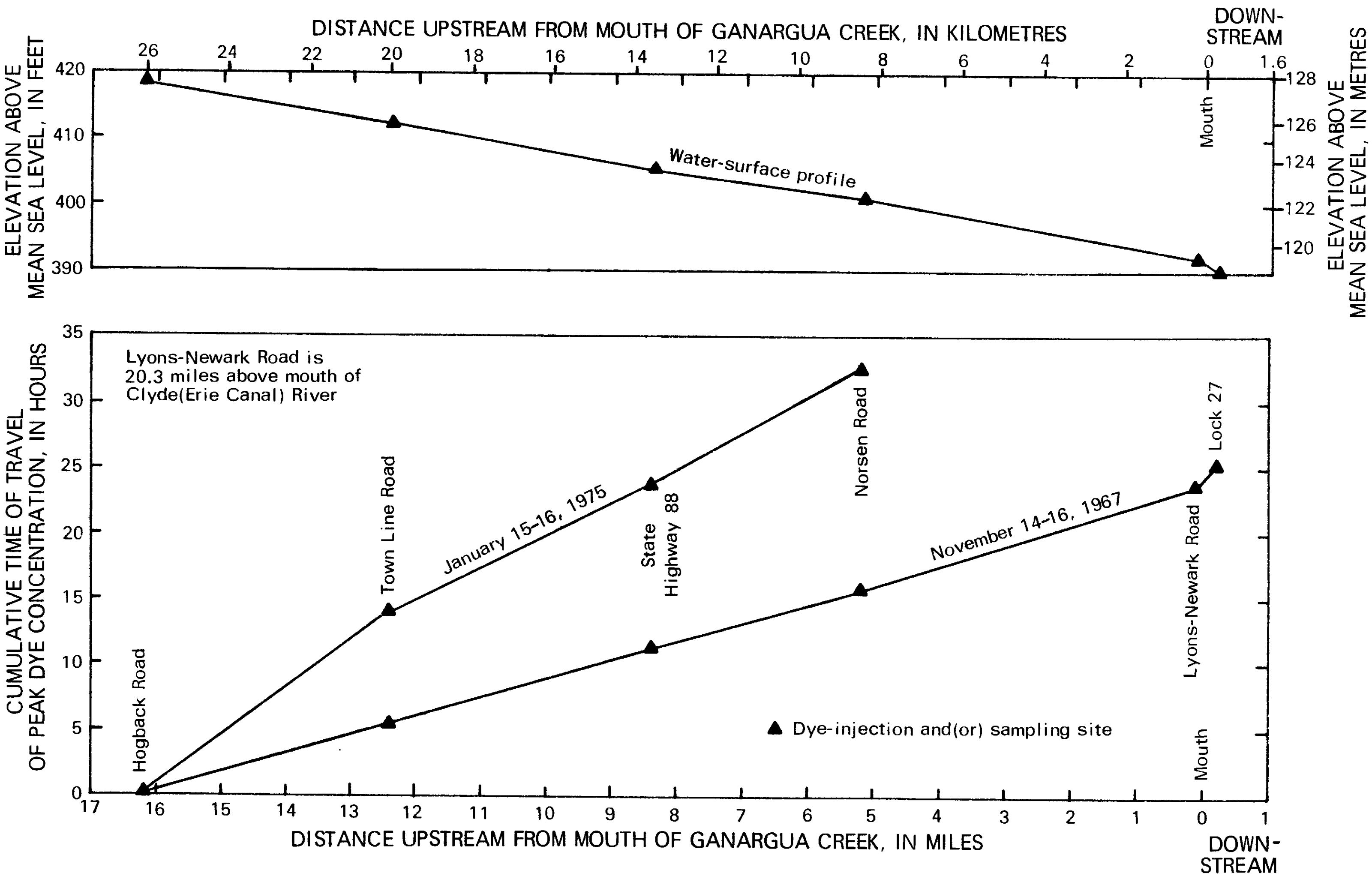


Figure 33.--Water-surface profile and cumulative time of travel of peak dye concentration for Ganargua Creek: Hogback Road to Erie Canal at Lock 27 at Lyons.

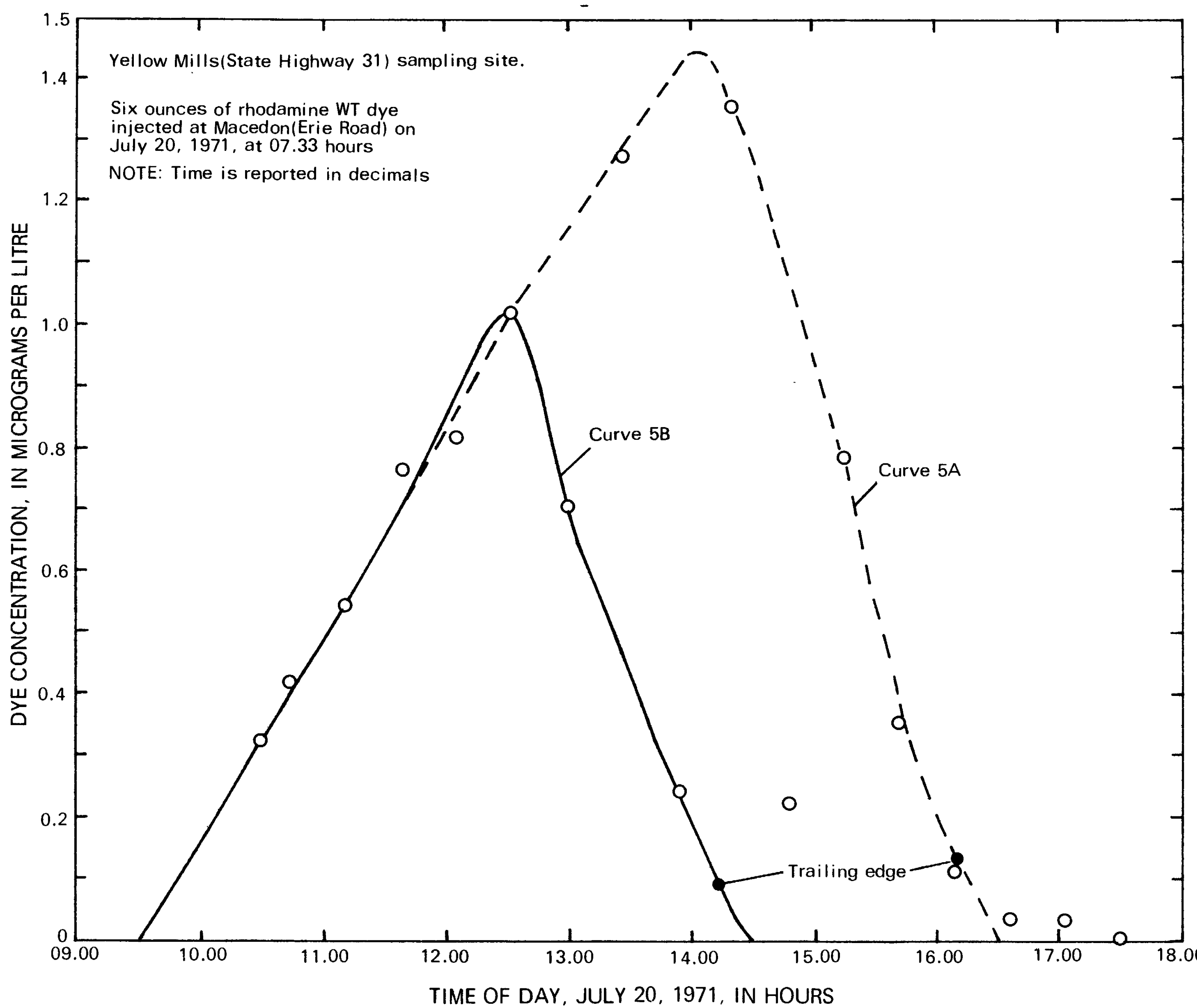


Figure 34.--Variation in concentration of dye with time for Ganargua Creek at State Highway 31 at Yellow Mills. Curve 5A (dashed line) represents backwater effect from canal; curve 5B, no backwater from canal.

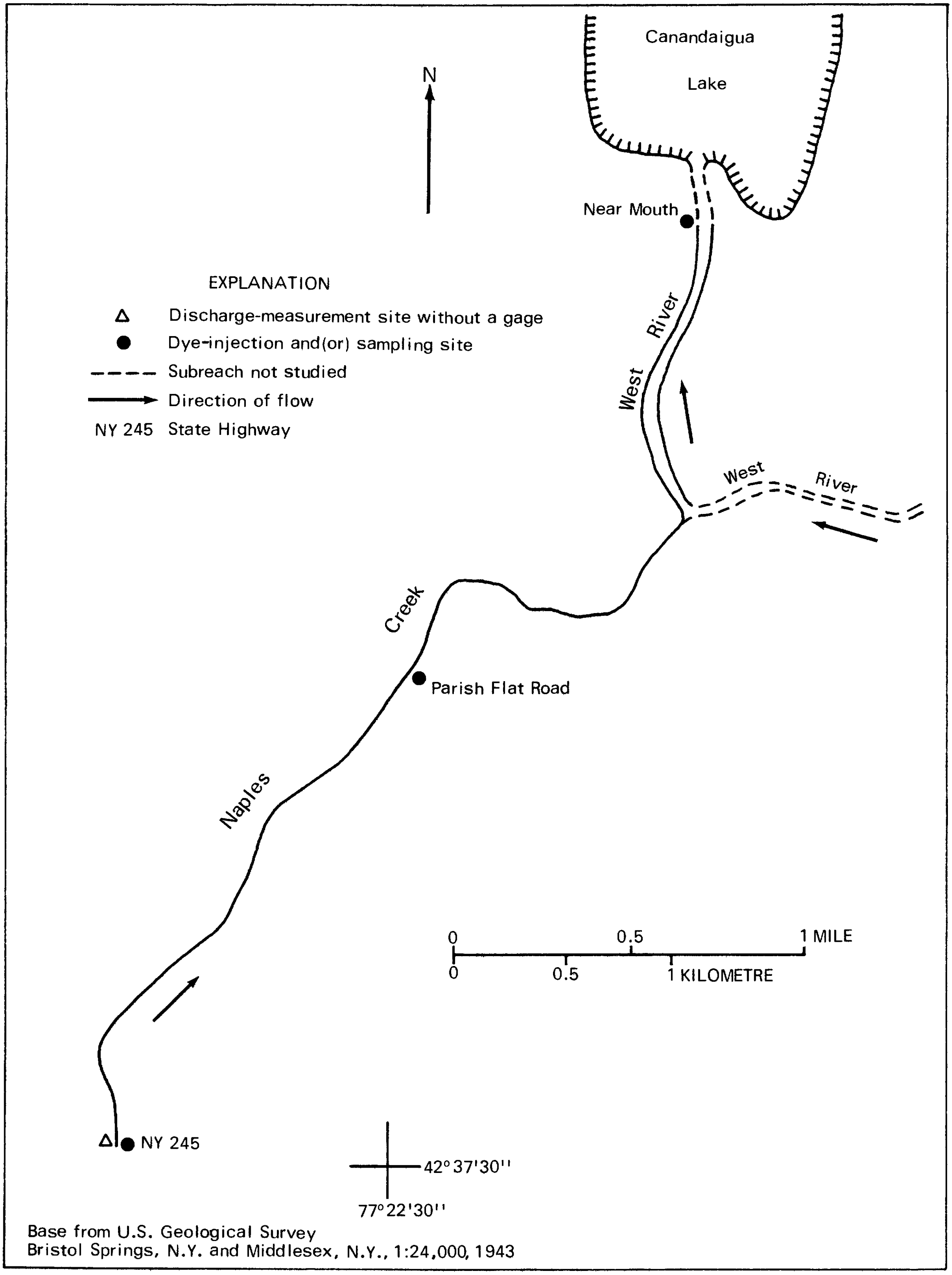


Figure 35.--Location of reach, subreaches, and measurement sites in the West River basin.

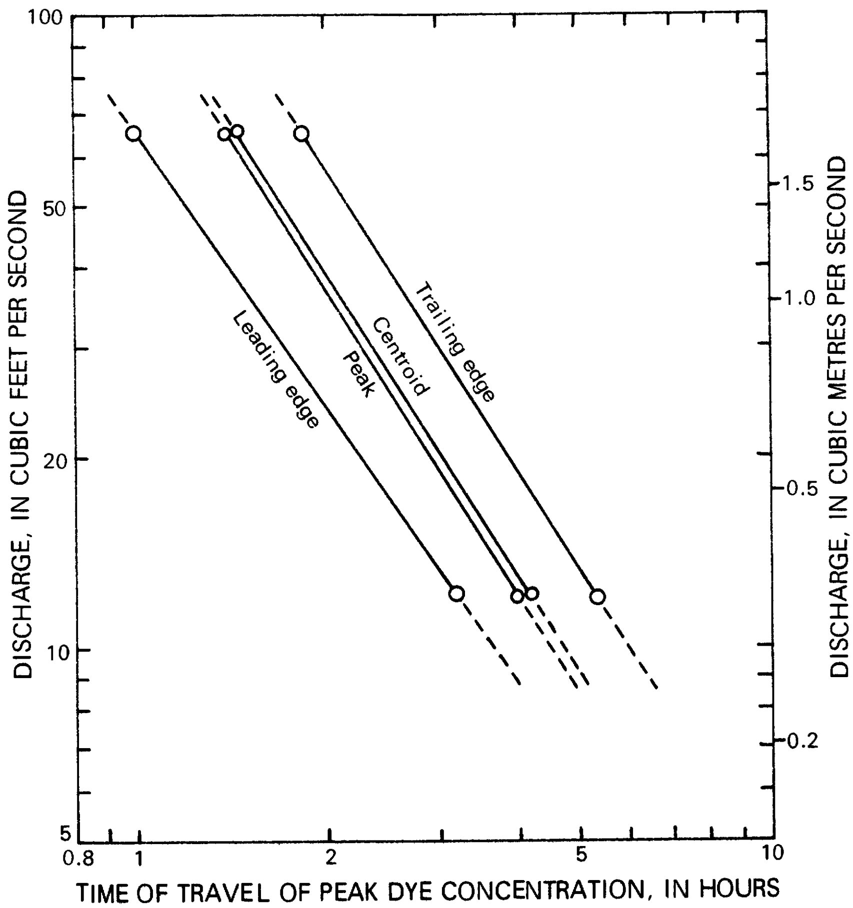


Figure 36.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Naples Creek: State Highway 245 to Parish Flat Road.

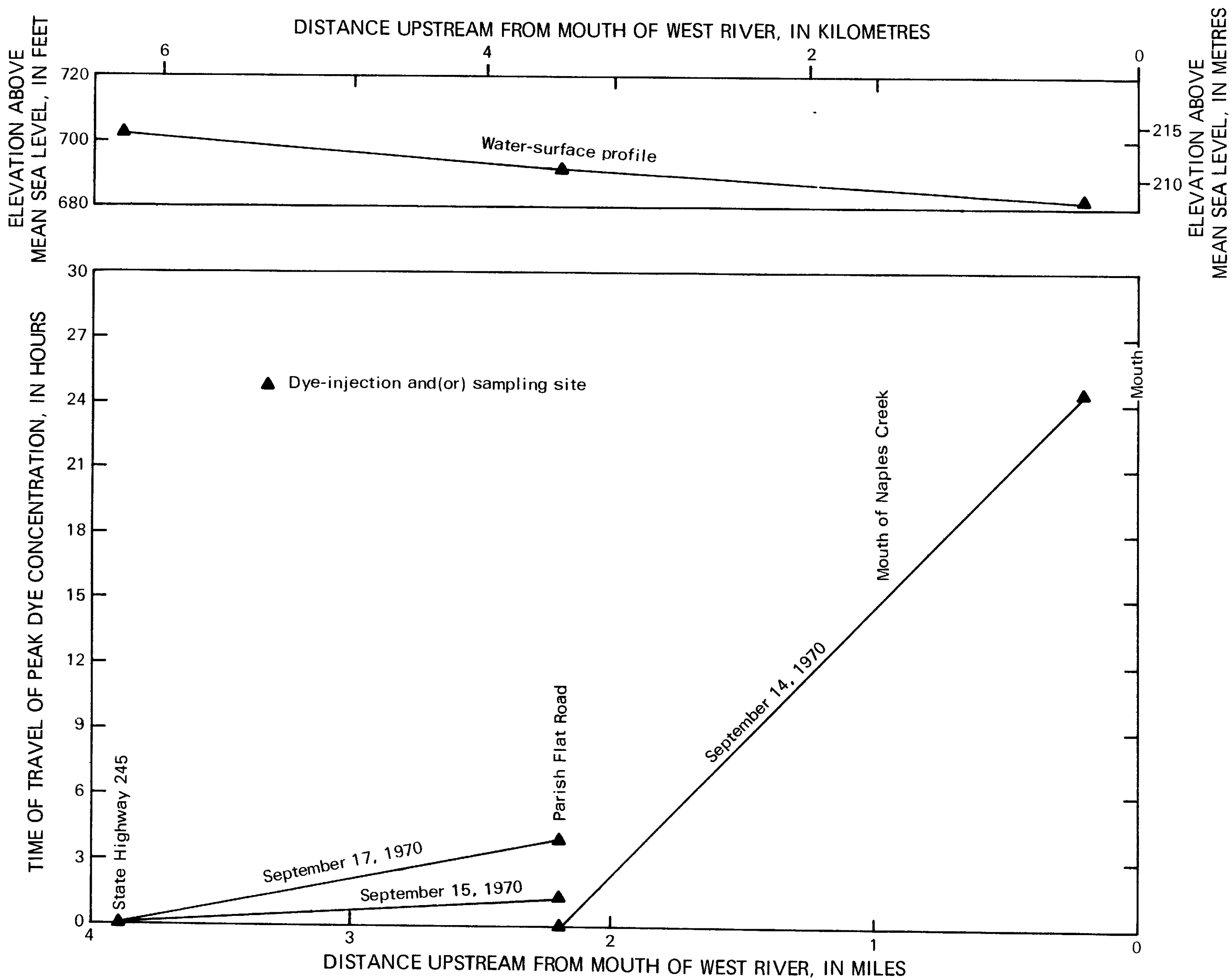


Figure 37.--Water-surface profile and time of travel of peak dye concentration for West River basin: State Highway 245 to near mouth of West River.

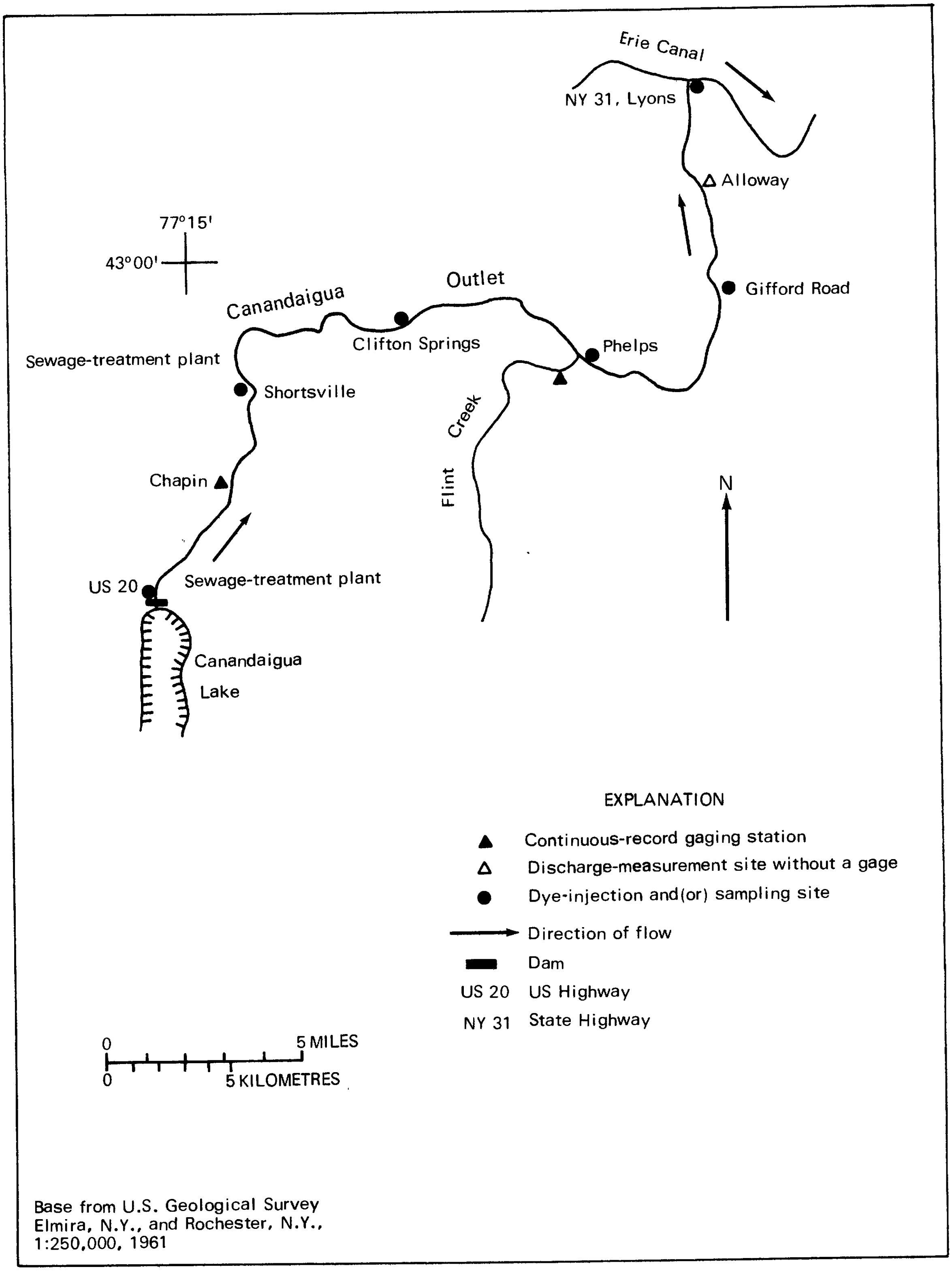


Figure 38.--Location of reach, subreaches, gaging stations, and measurement sites on Canandaigua Outlet.

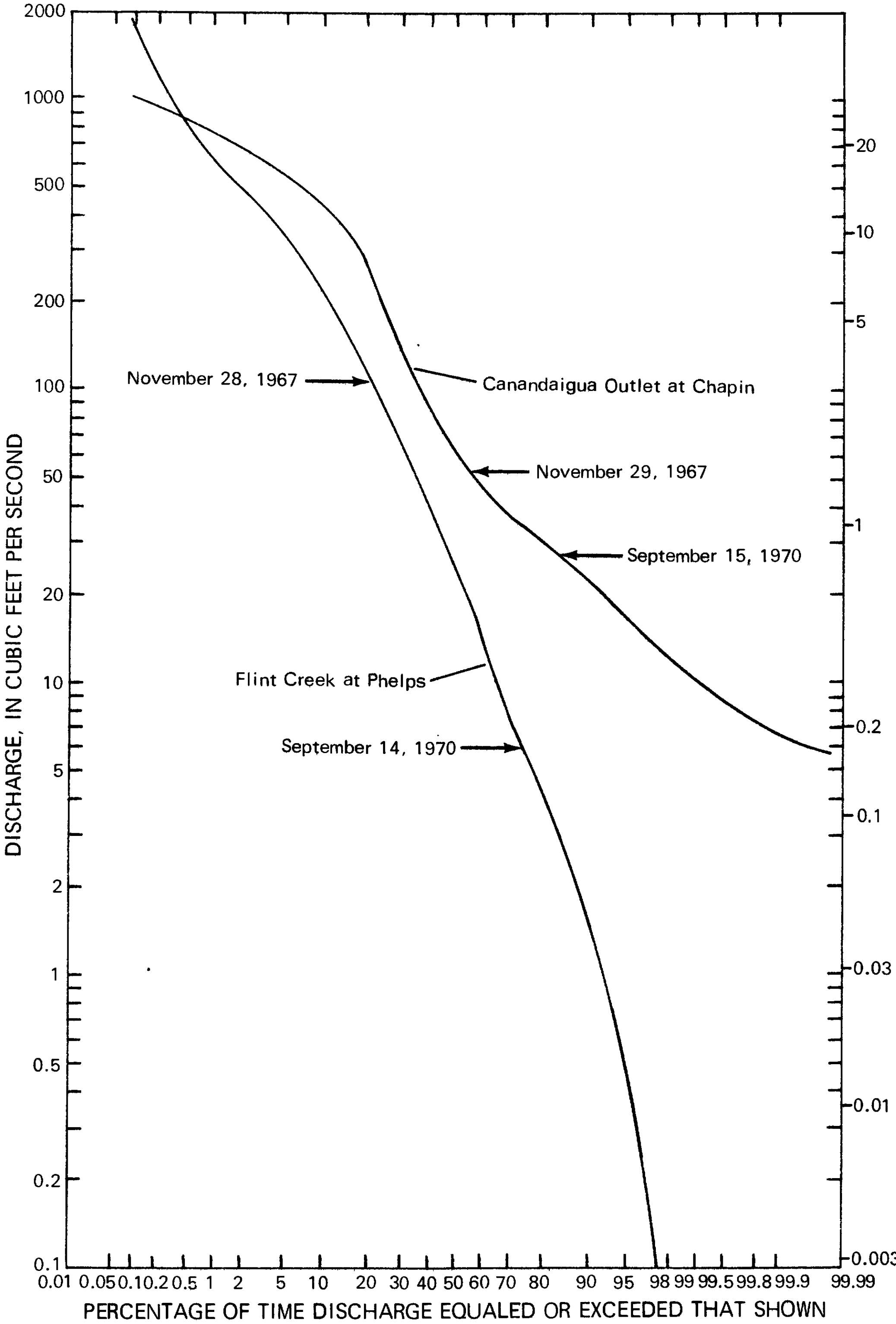


Figure 39.--Duration curves of daily mean flows for Flint Creek at Phelps and Canandaigua Outlet at Chapin.

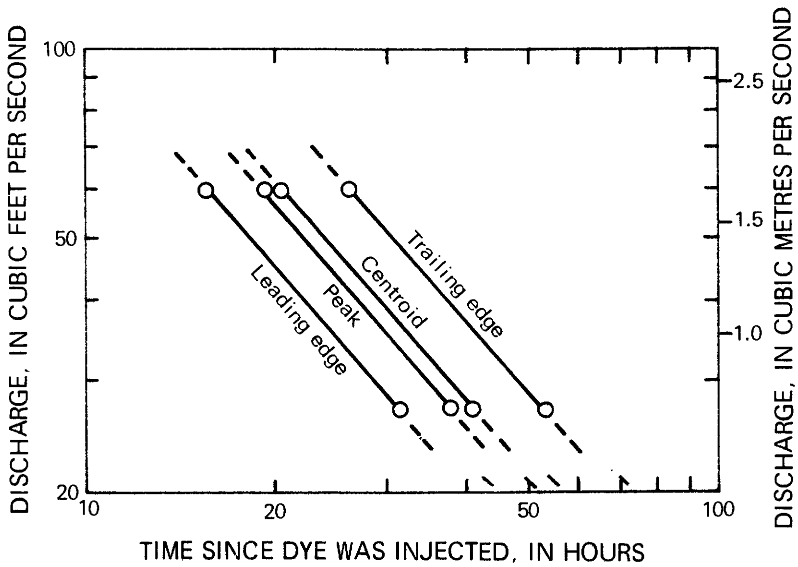


Figure 40.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Canandaigua Outlet: U.S. Highway 20 at Canandaigua to Shortsville.

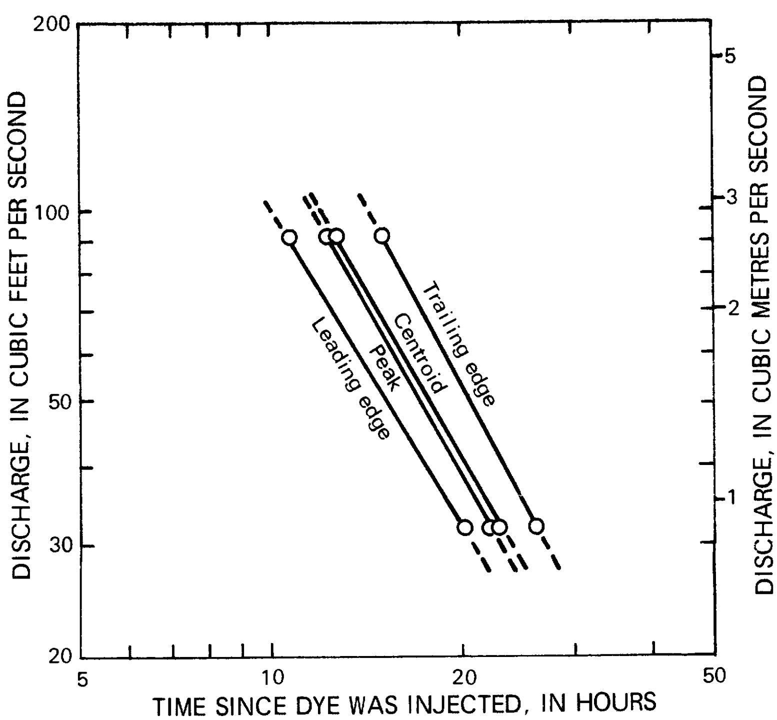


Figure 41.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Canandaigua Outlet: Shortsville to Clifton Springs.

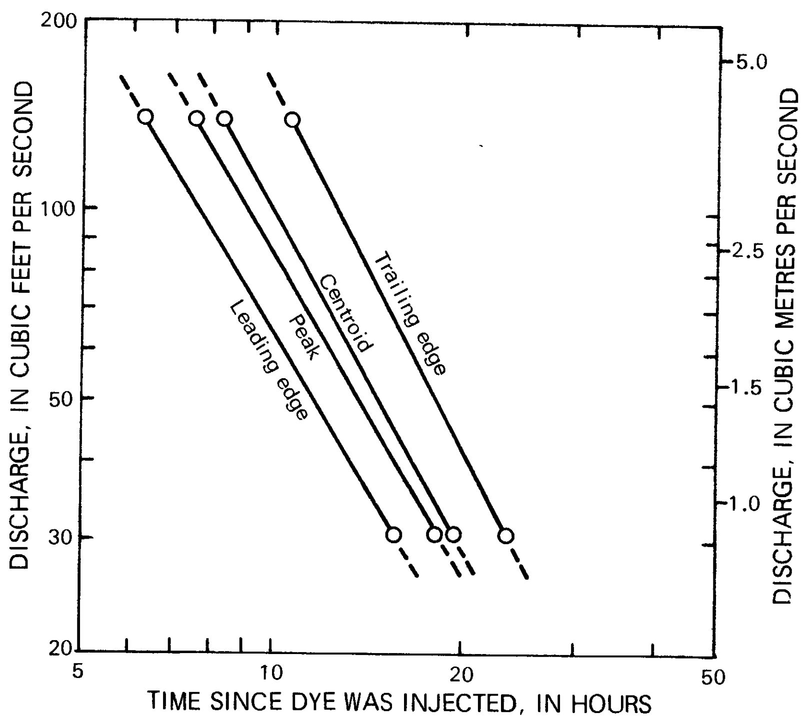


Figure 42.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Canandaigua Outlet: Clifton Springs to mouth of Flint Creek at Phelps.

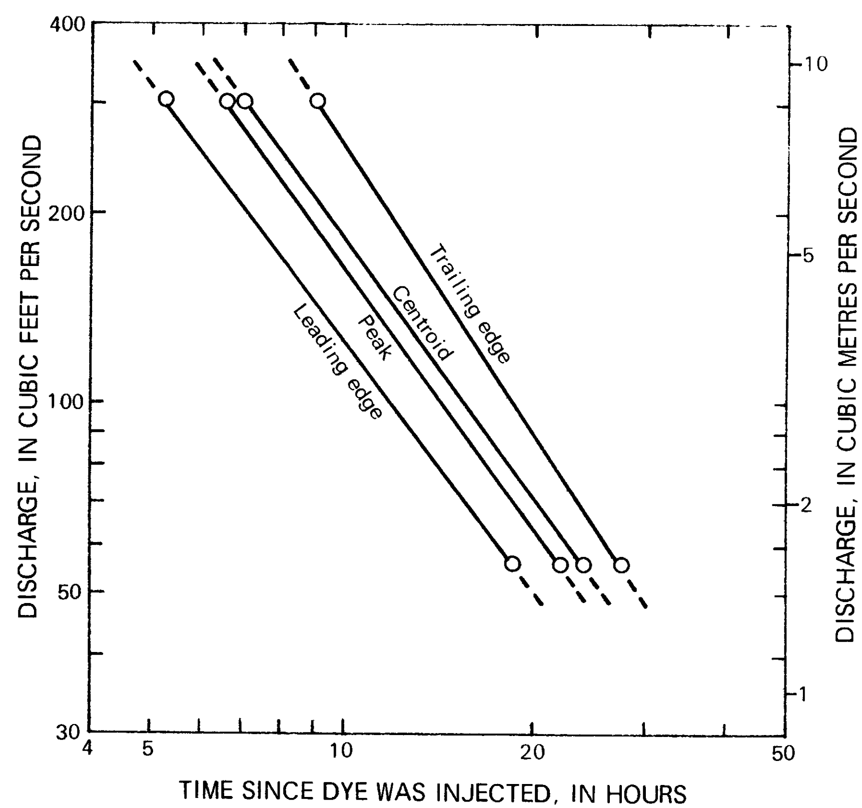


Figure 43.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Canandaigua Outlet: mouth of Flint Creek at Phelps to Gifford Road.

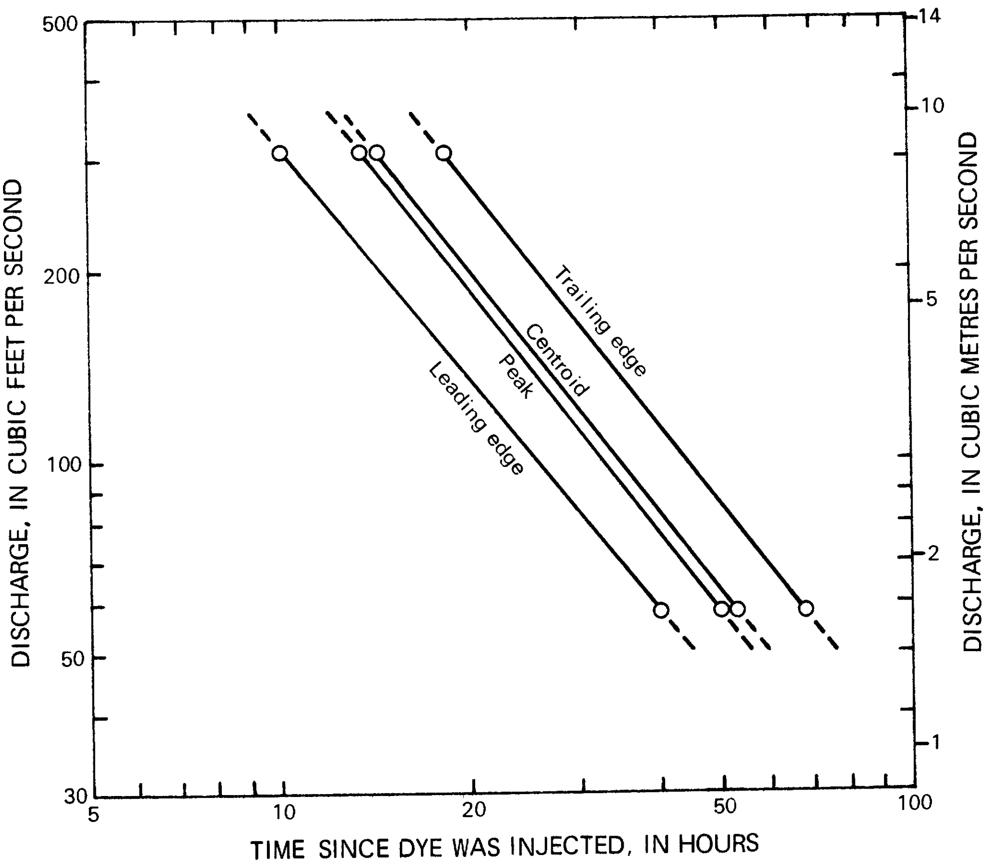


Figure 44.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Canandaigua Outlet: Gifford Road to State Highway 31 at Lyons.

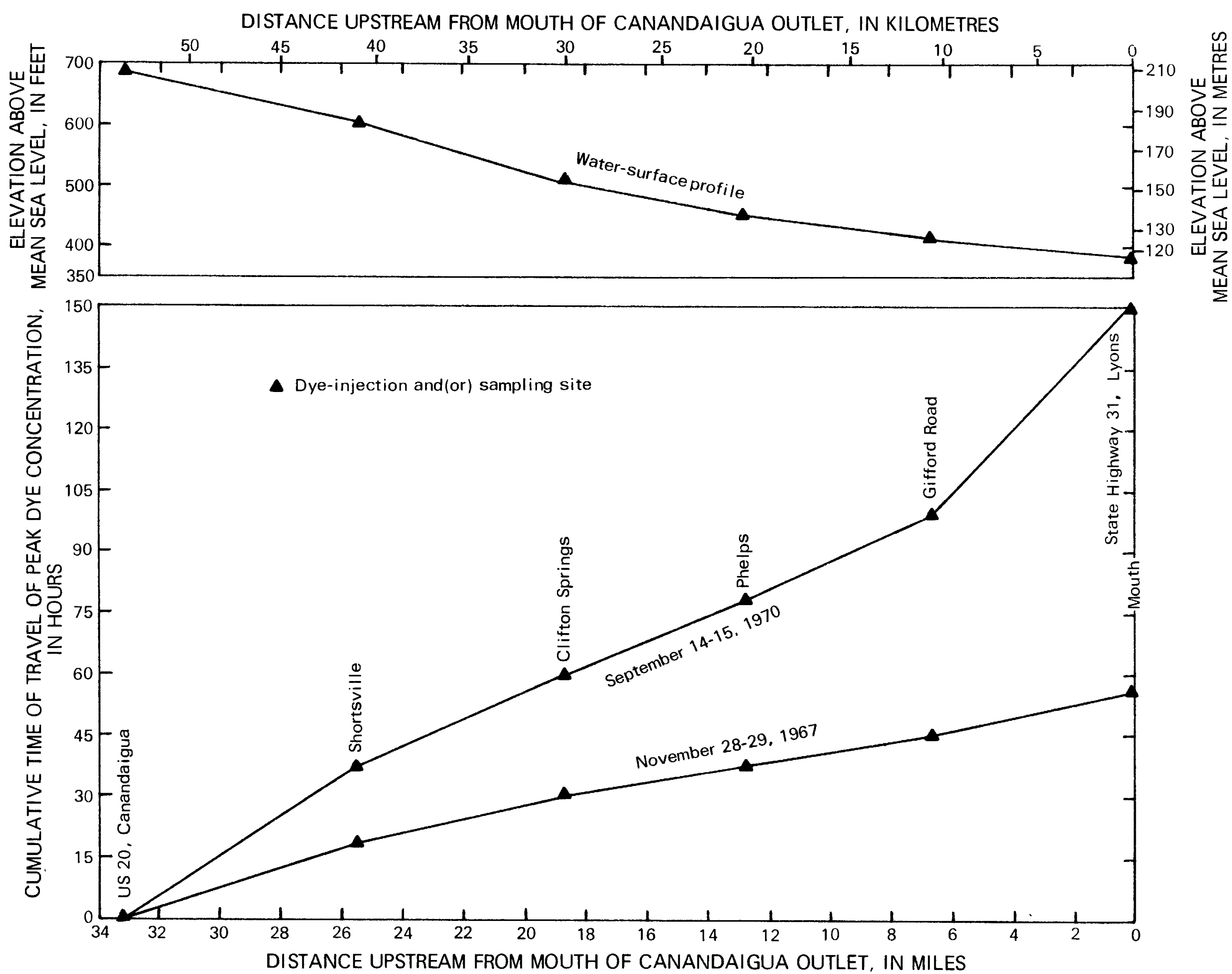


Figure 45.--Water-surface profile and cumulative time of travel of peak dye concentration for Canandaigua Outlet: U.S. Highway 20 at Canandaigua to State Highway 31 at Lyons.

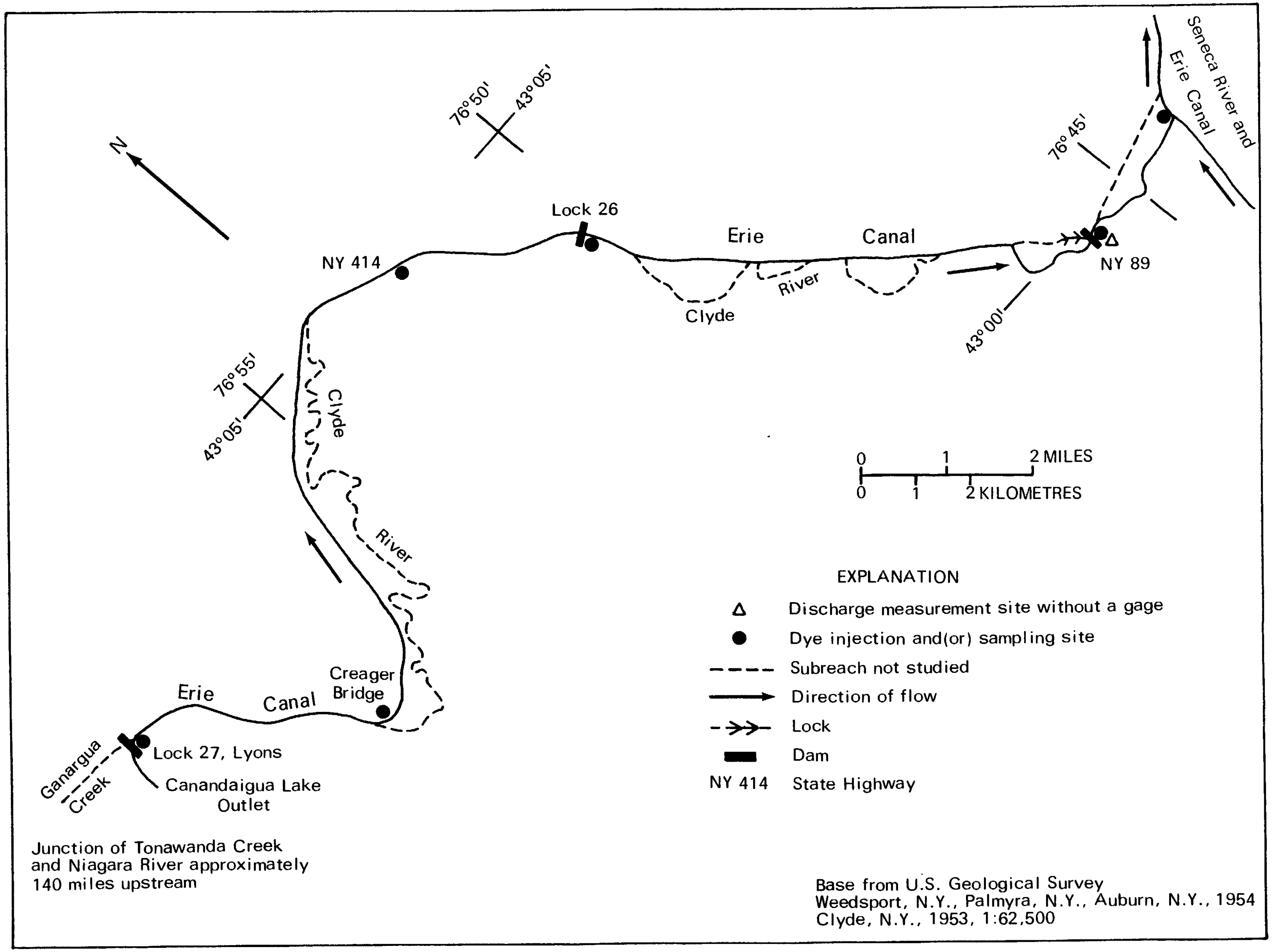


Figure 46.--Location of reach, subreaches, and measurement sites on Clyde River and Erie Canal.

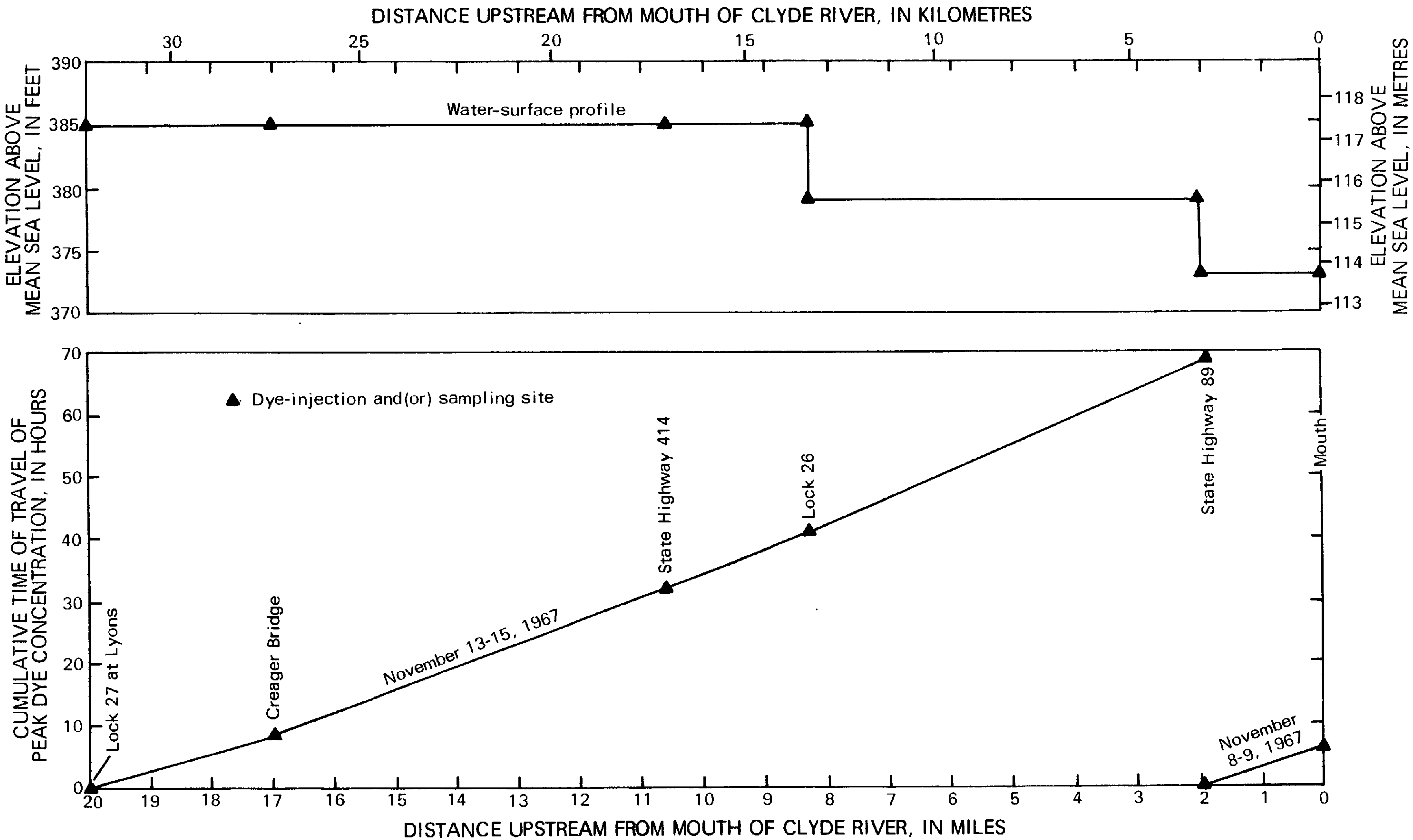


Figure 47.--Water-surface profile and cumulative time of travel of peak dye concentration for Clyde River and Erie Canal: Lock 27 at Lyons to mouth.

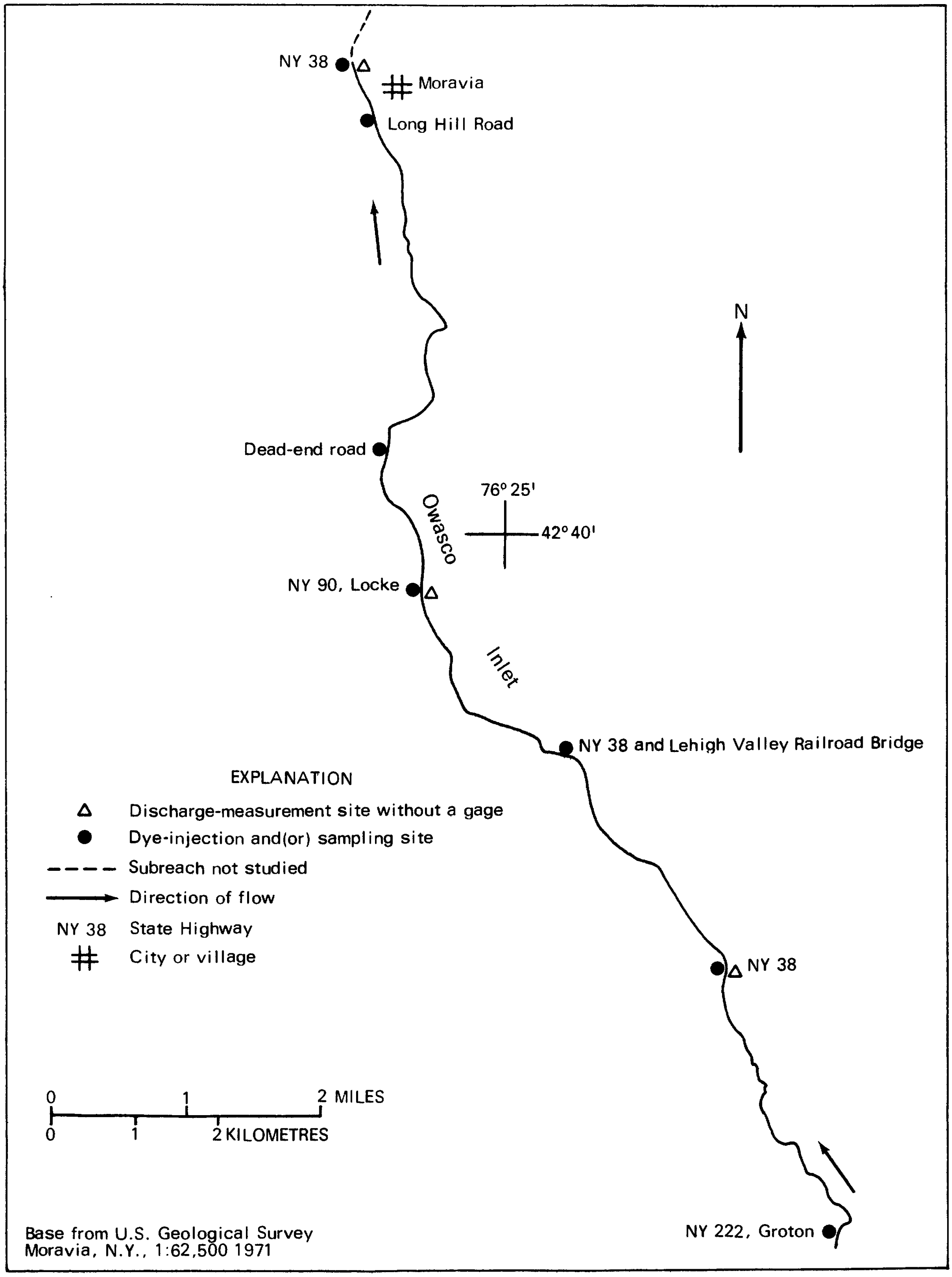


Figure 48.--Location of reach, subreaches, and measurement sites on Owasco Inlet.

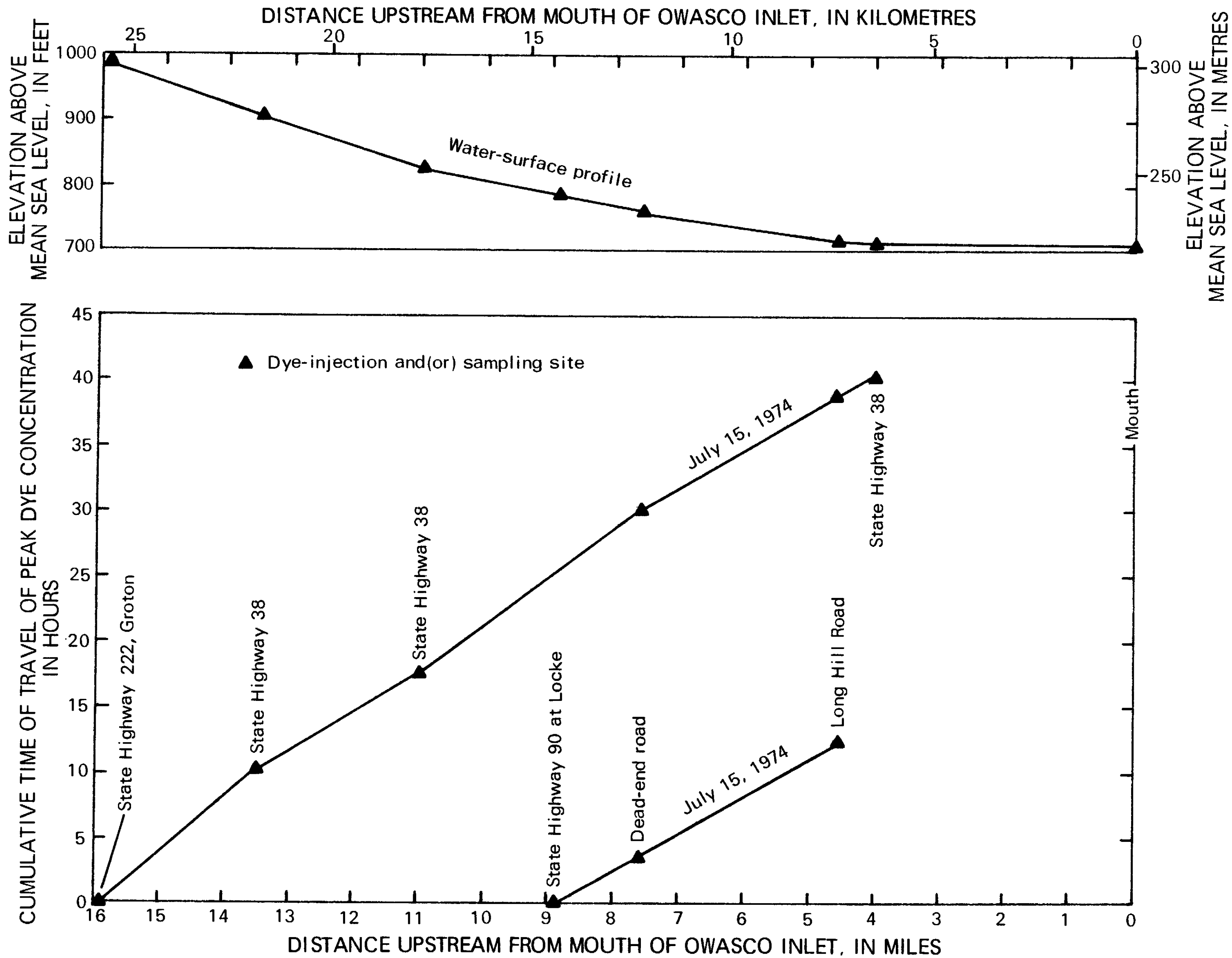


Figure 49.--Water-surface profile and cumulative time of travel of peak dye concentration for Owasco Inlet: Groton to Moravia.

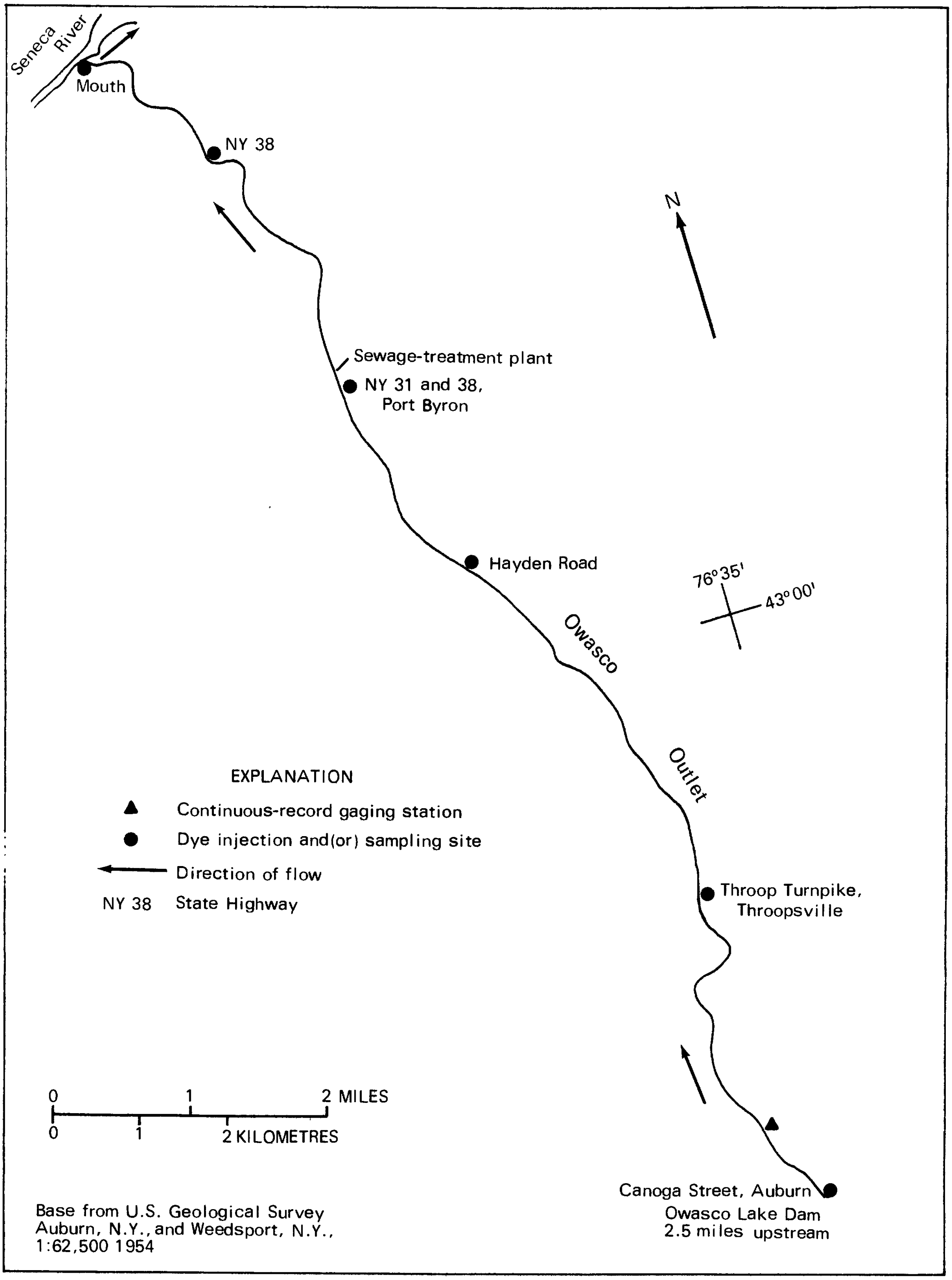


Figure 50.--Location of reach, subreaches, and gaging station on Owasco Outlet.

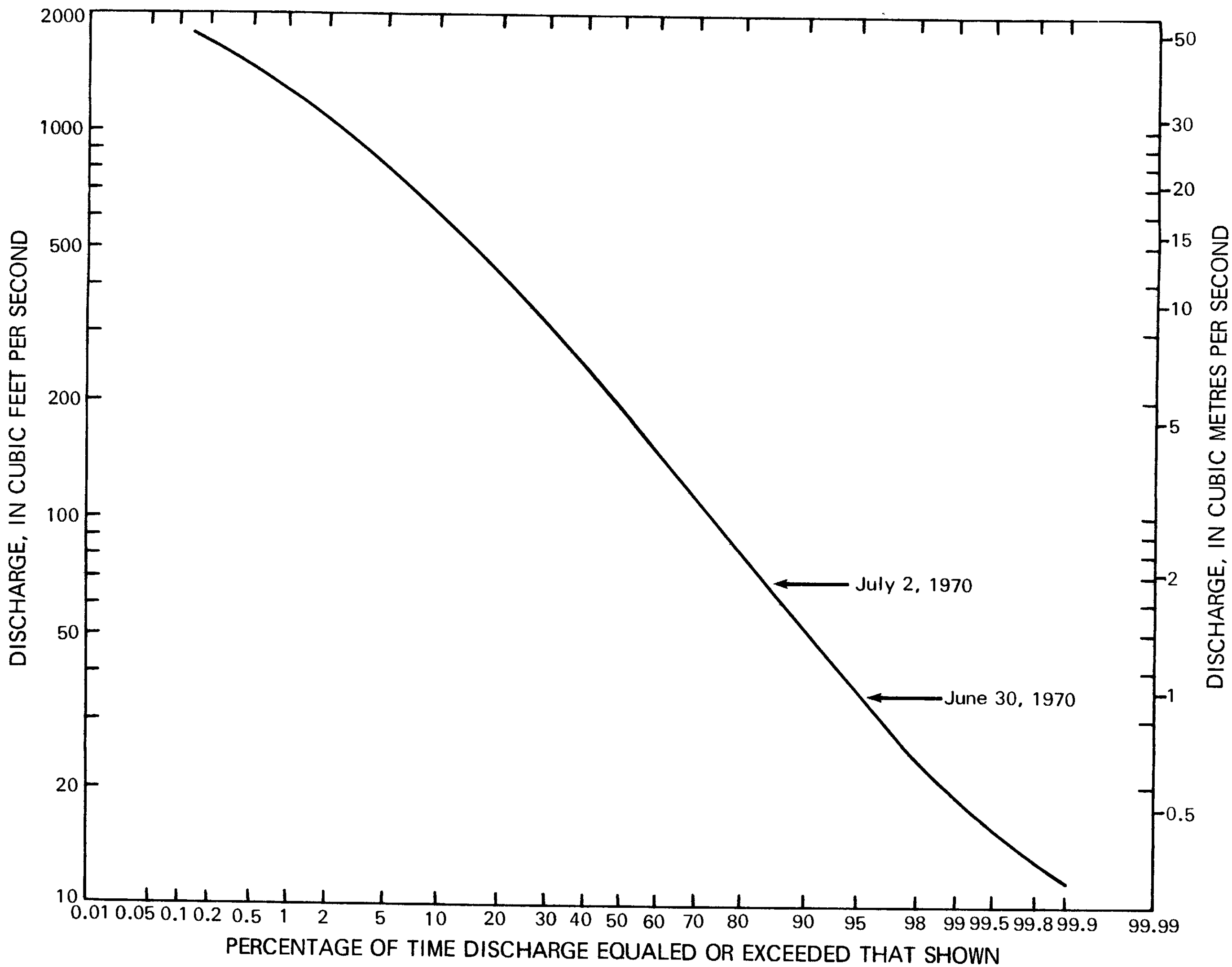


Figure 51.--Duration curve of daily mean flows for Owasco Outlet near Auburn.

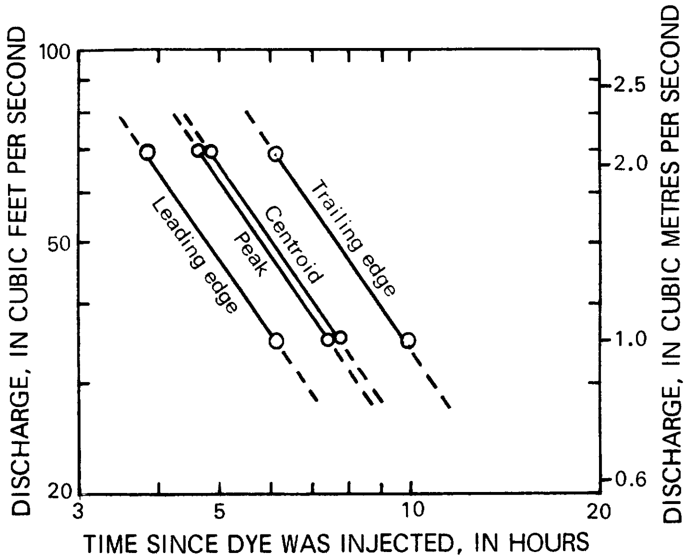


Figure 52.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Owasco Outlet: subreach Canoga Street at Auburn to Throopsville.

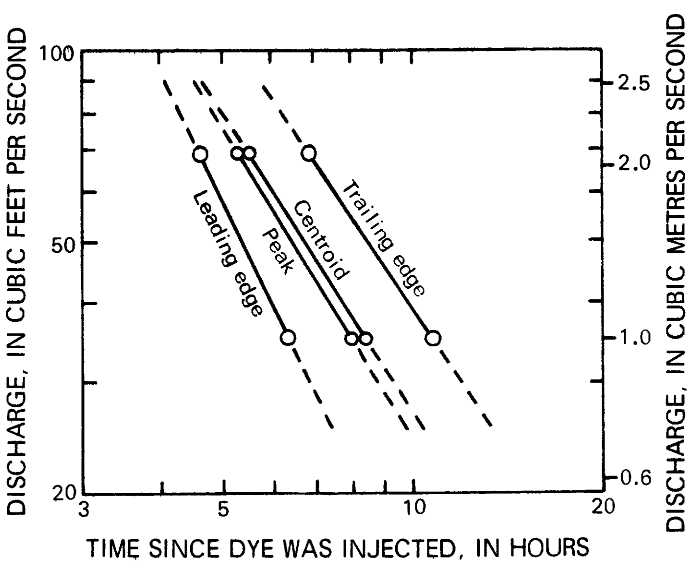


Figure 53.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Owasco Outlet: subreach Throopsville to Hayden Road.

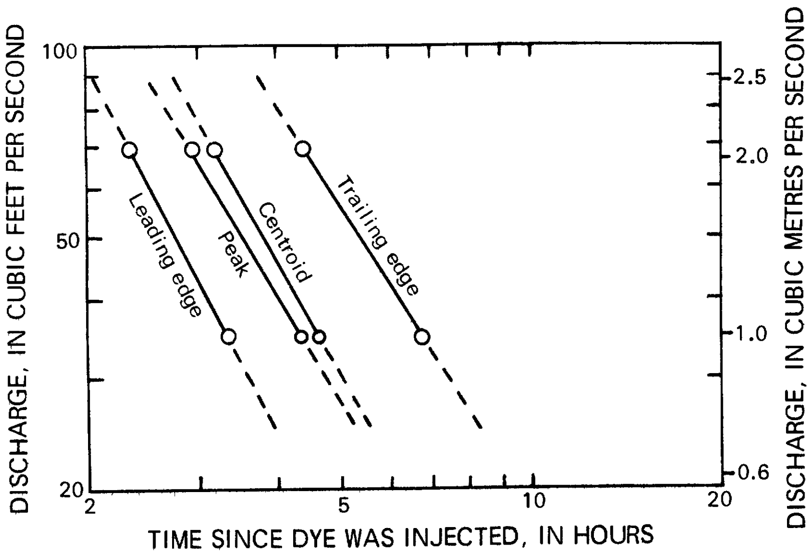


Figure 54.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Owasco Outlet: subreach Hayden Road to State Highways 31 and 38 at Port Byron.

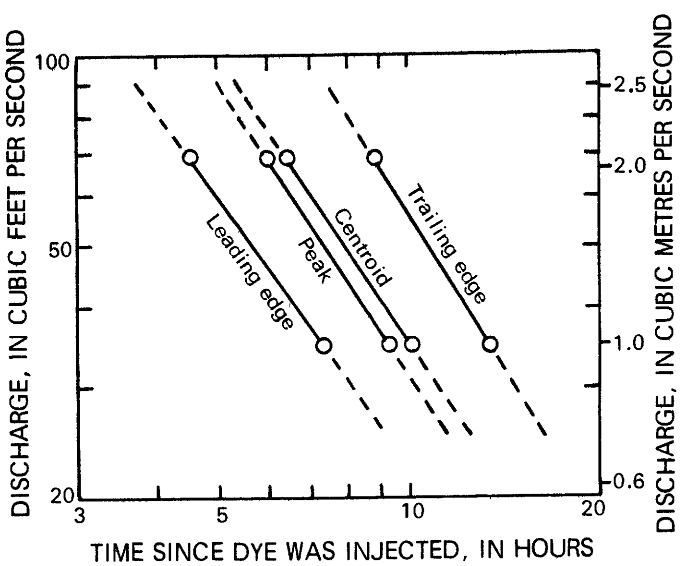


Figure 55.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Owasco Outlet: State Highways 31 and 38 at Port Byron to State Highway 38.

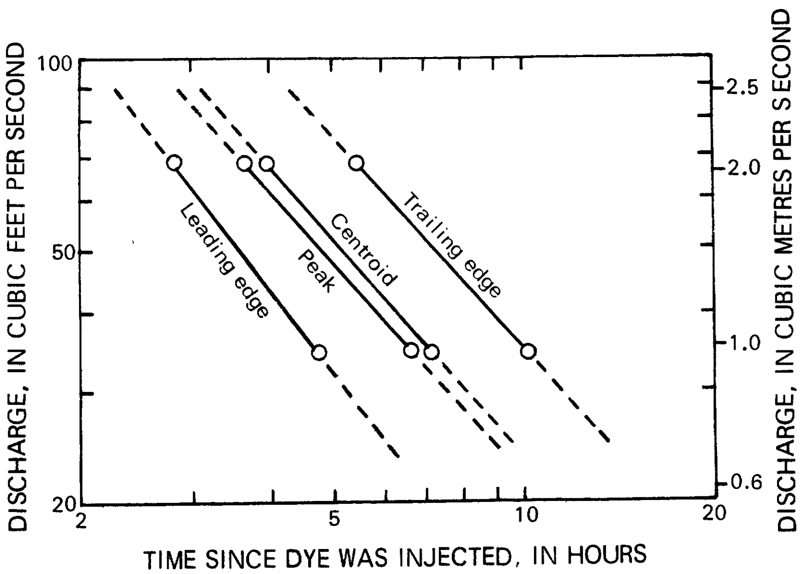


Figure 56.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Owasco Outlet: State Highway 38 to mouth.

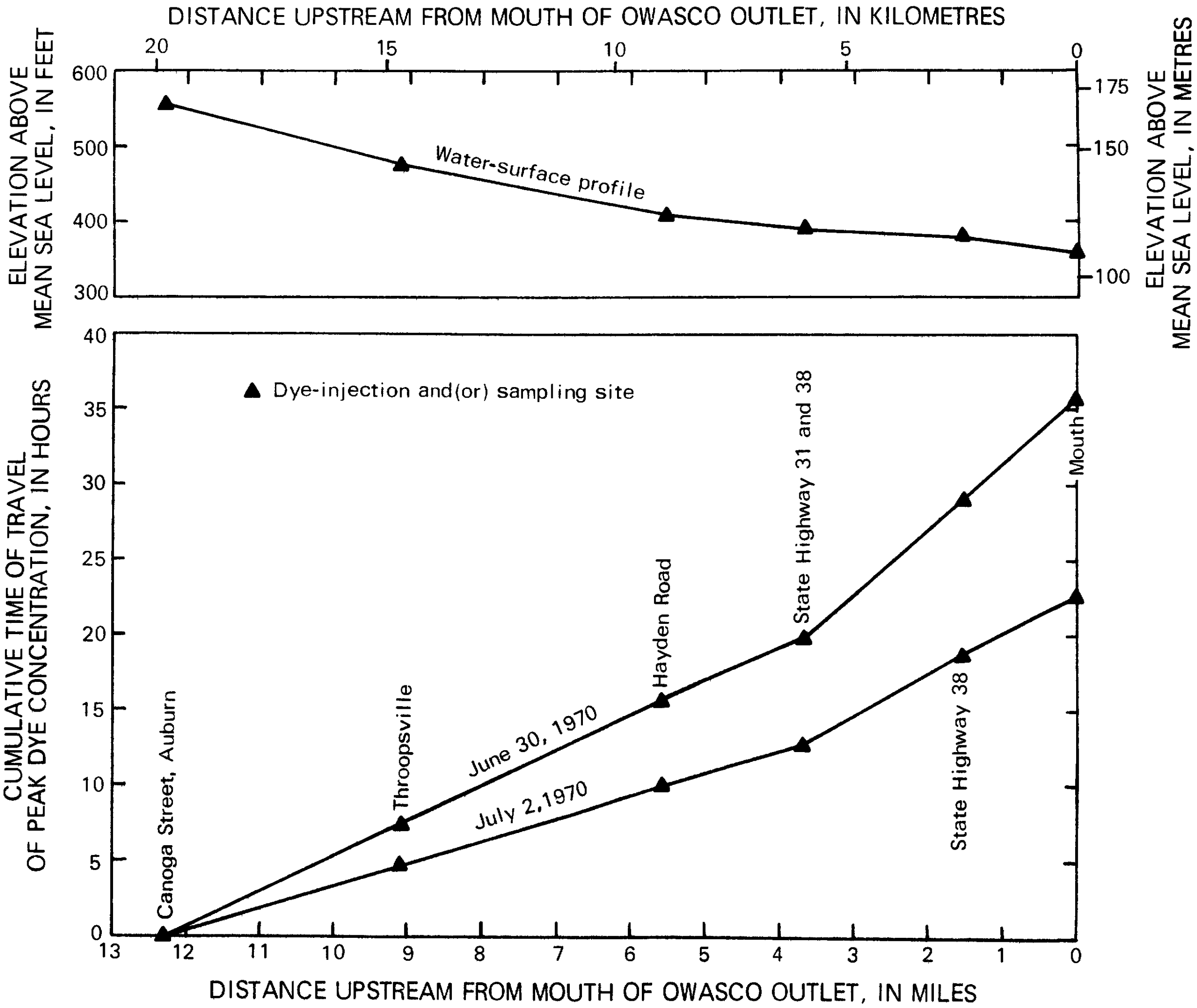


Figure 57.--Water-surface profile and cumulative time of travel of peak dye concentration for Owasco Outlet: Auburn to mouth.

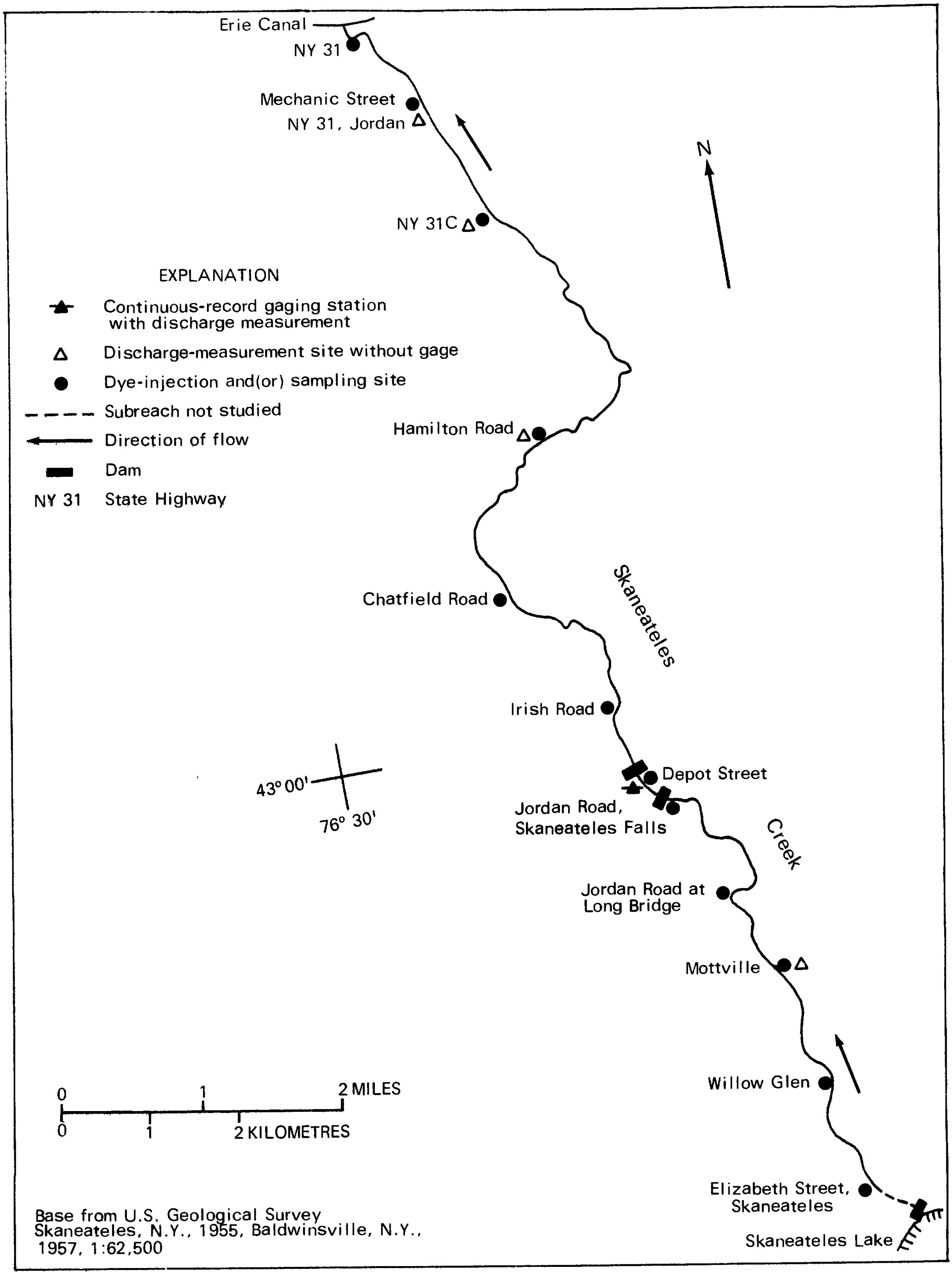


Figure 58.--Location of reach, subreaches, gaging station, and measurement sites on Skaneateles Creek.

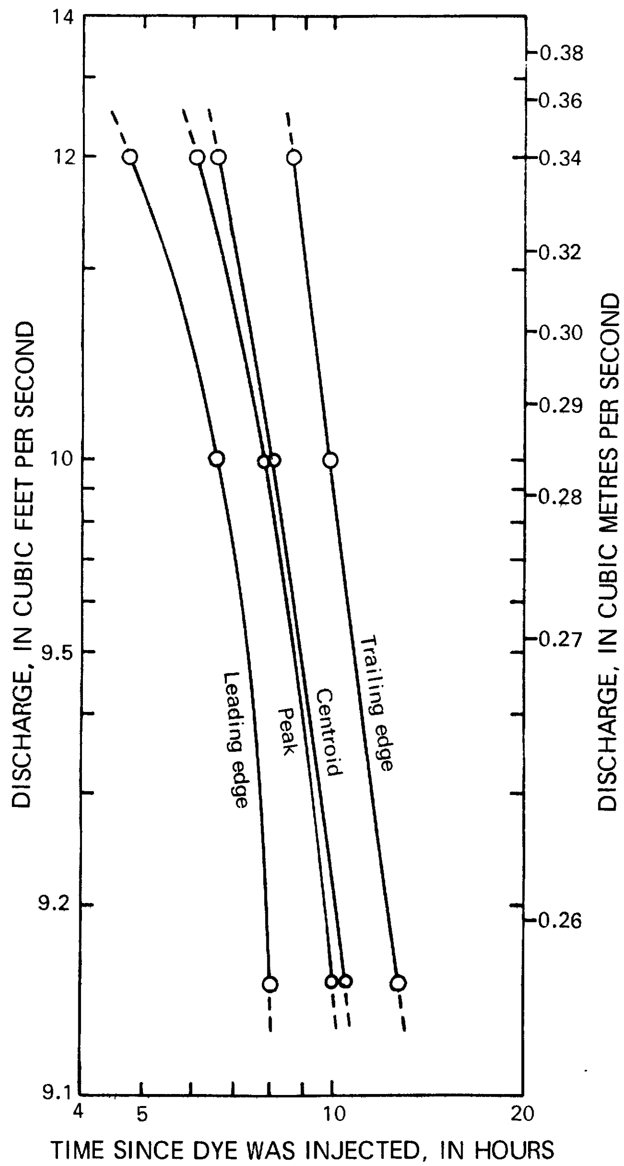


Figure 59.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Skaneateles Creek: Elizabeth Street at Skaneateles to Mottville.

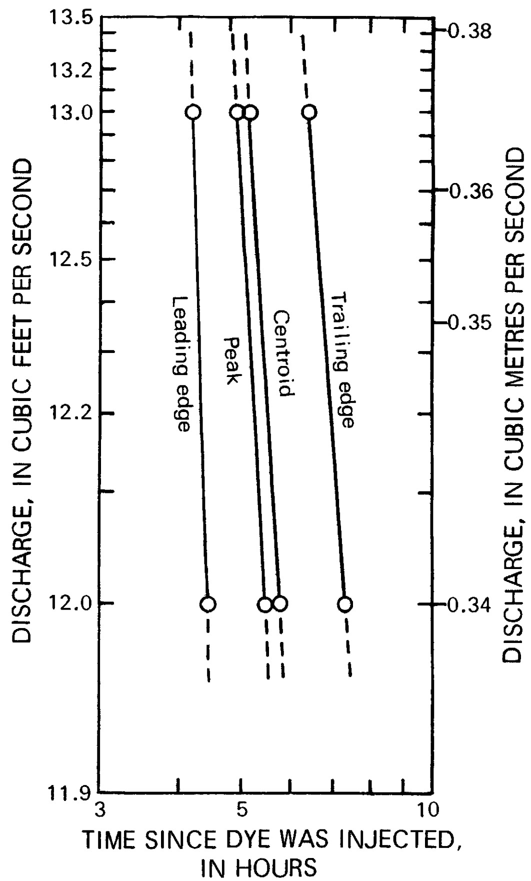


Figure 60.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Skaneateles Creek: Mottville to Jordan Road at Skaneateles Falls.

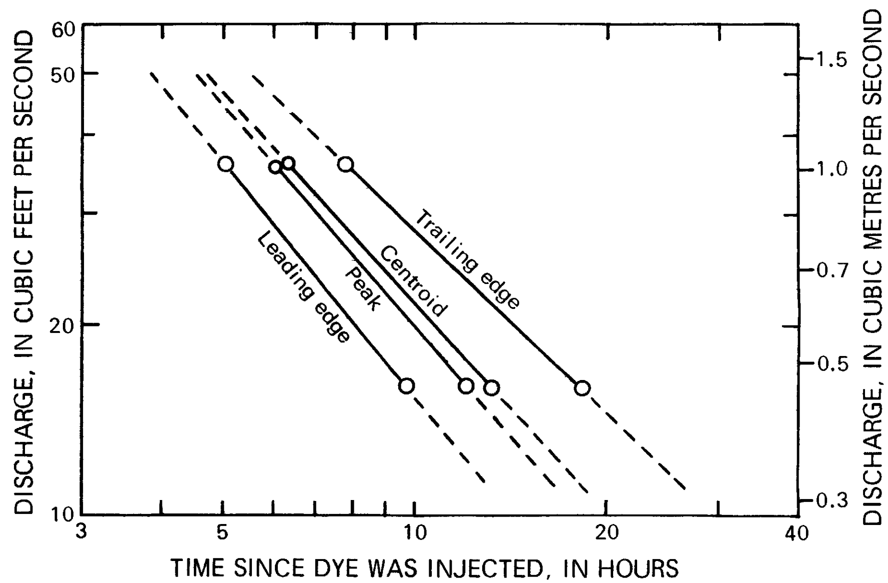


Figure 61.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Skaneateles Creek: Hamilton Road to State Highway 31 at Jordan.

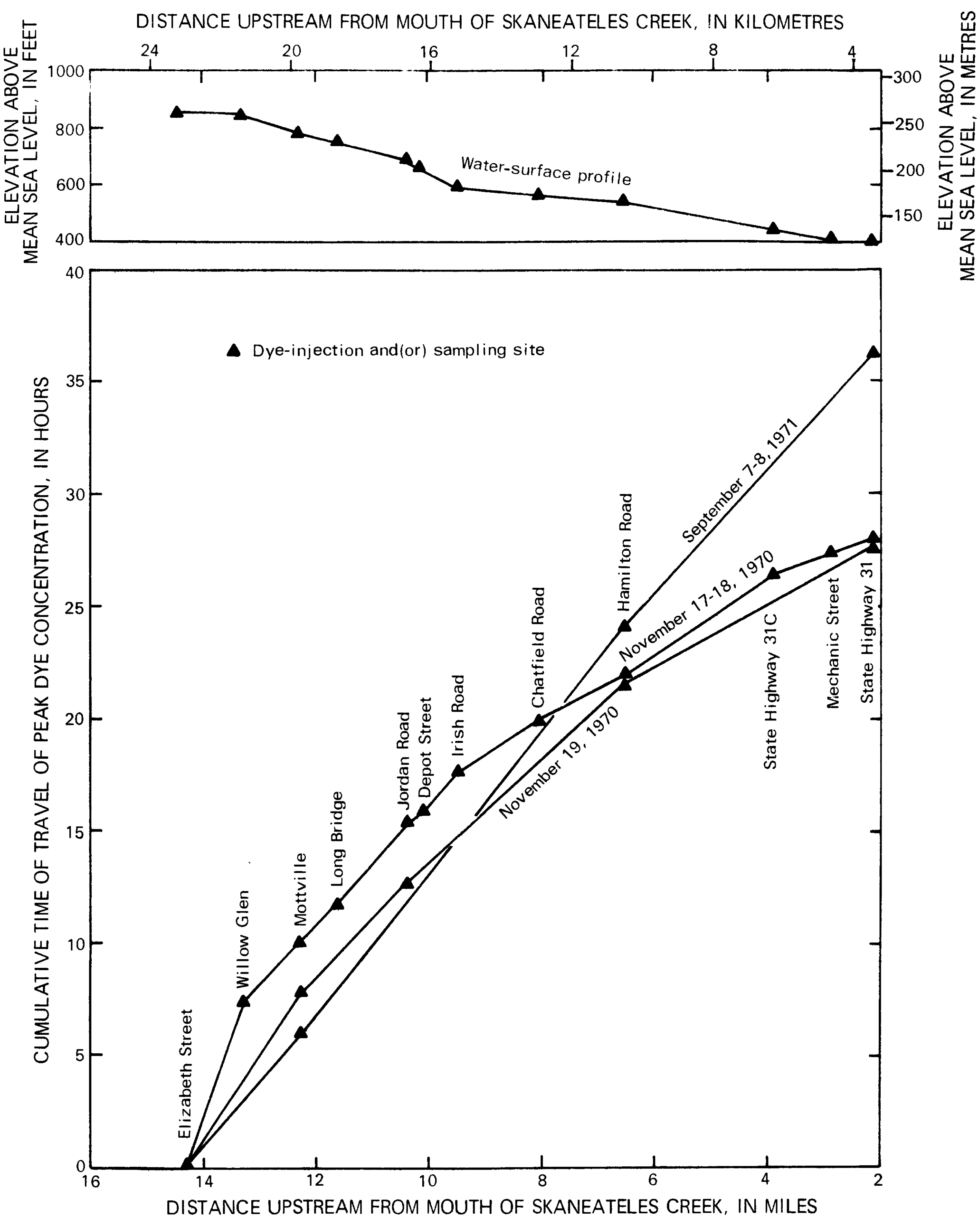


Figure 62.--Water-surface profile and cumulative time of travel of peak dye concentration for Skaneateles Creek: Elizabeth Street at Skaneateles to State Highway 31 at Jordan.

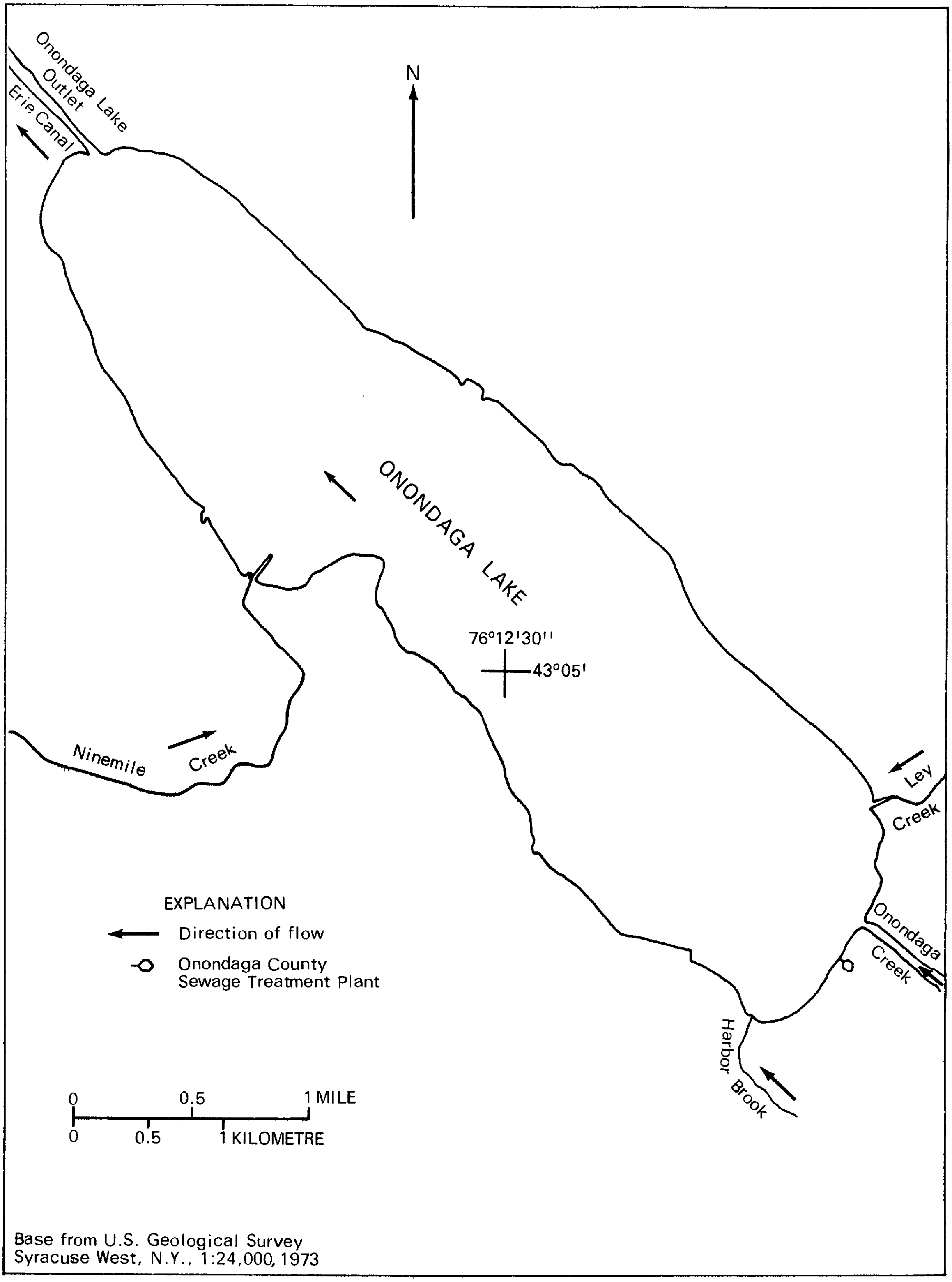
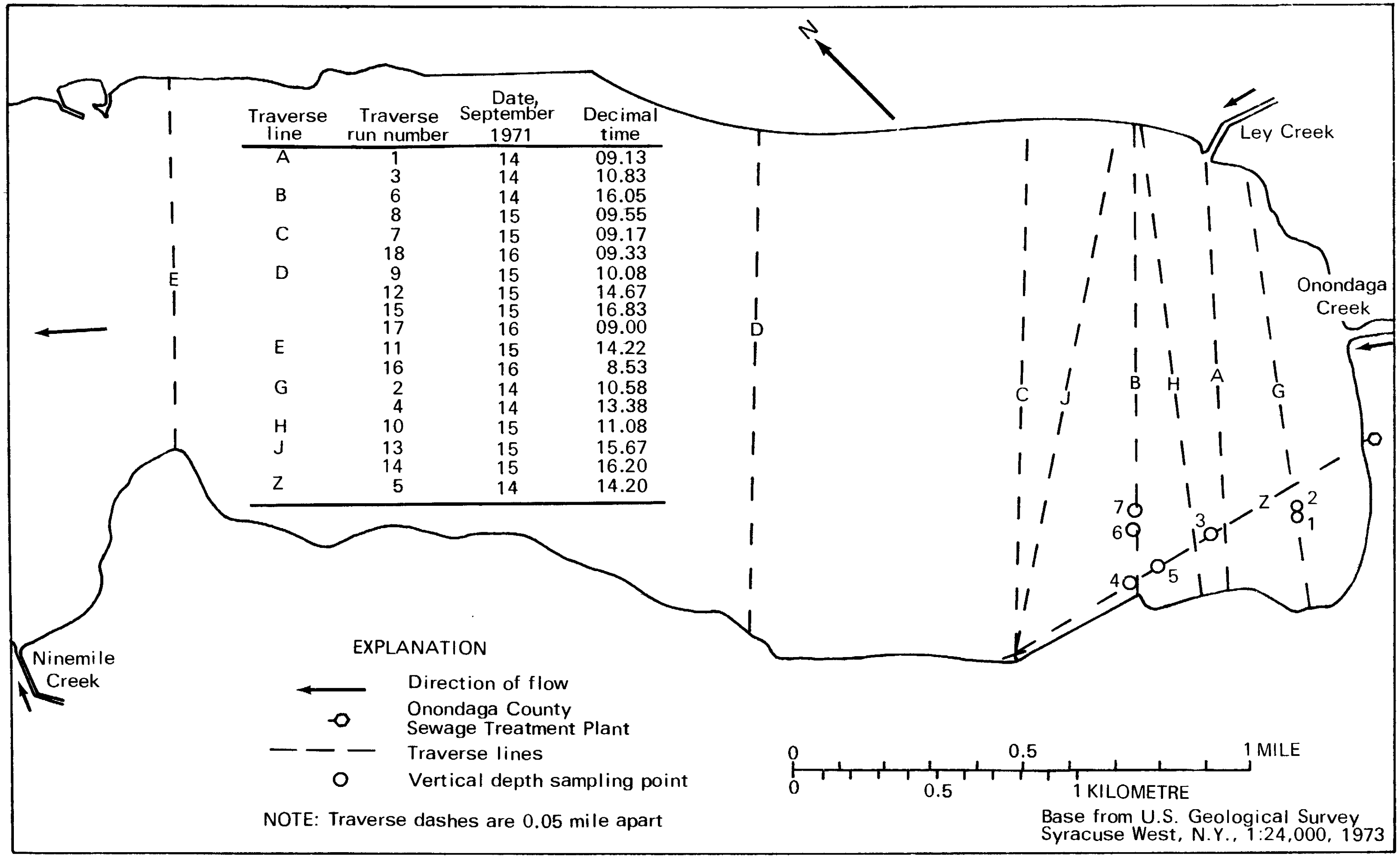


Figure 63.--Location of study area for Onondaga Lake dye-dispersion study.



Traverse line	Traverse run number	Date, September 1971	Decimal time
A	1	14	09.13
	3	14	10.83
B	6	14	16.05
	8	15	09.55
C	7	15	09.17
	18	16	09.33
D	9	15	10.08
	12	15	14.67
	15	15	16.83
	17	16	09.00
E	11	15	14.22
	16	16	8.53
G	2	14	10.58
	4	14	13.38
H	10	15	11.08
J	13	15	15.67
	14	15	16.20
Z	5	14	14.20

Figure 64.--Location of traverse lines and vertical depth sampling points during dye-dispersion study on part of Onondaga Lake, September 14-16, 1971.

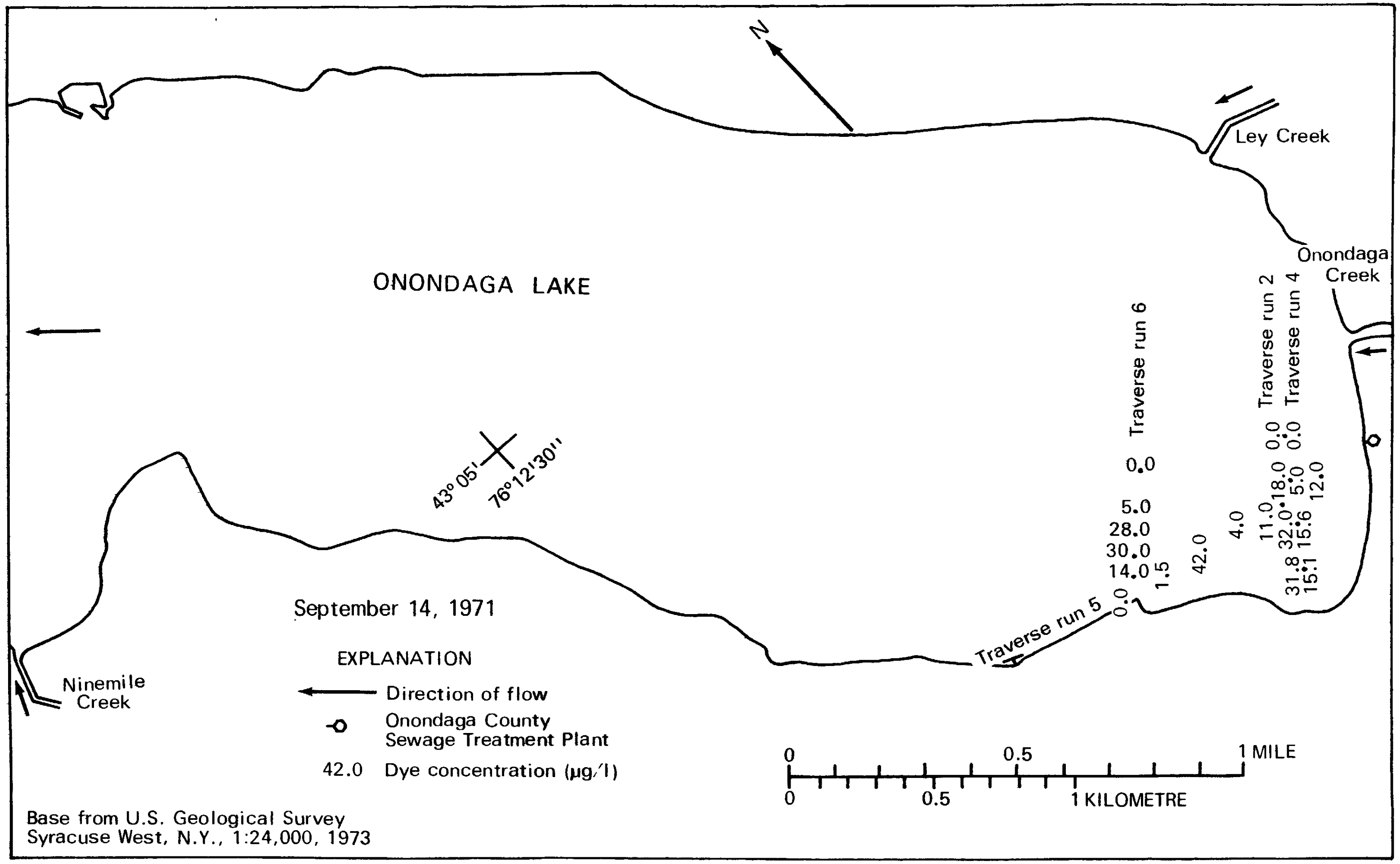


Figure 65.--Dye concentrations (µg/l) found during traverse runs on part of Onondaga Lake during dye-dispersion study, September 14, 1971.

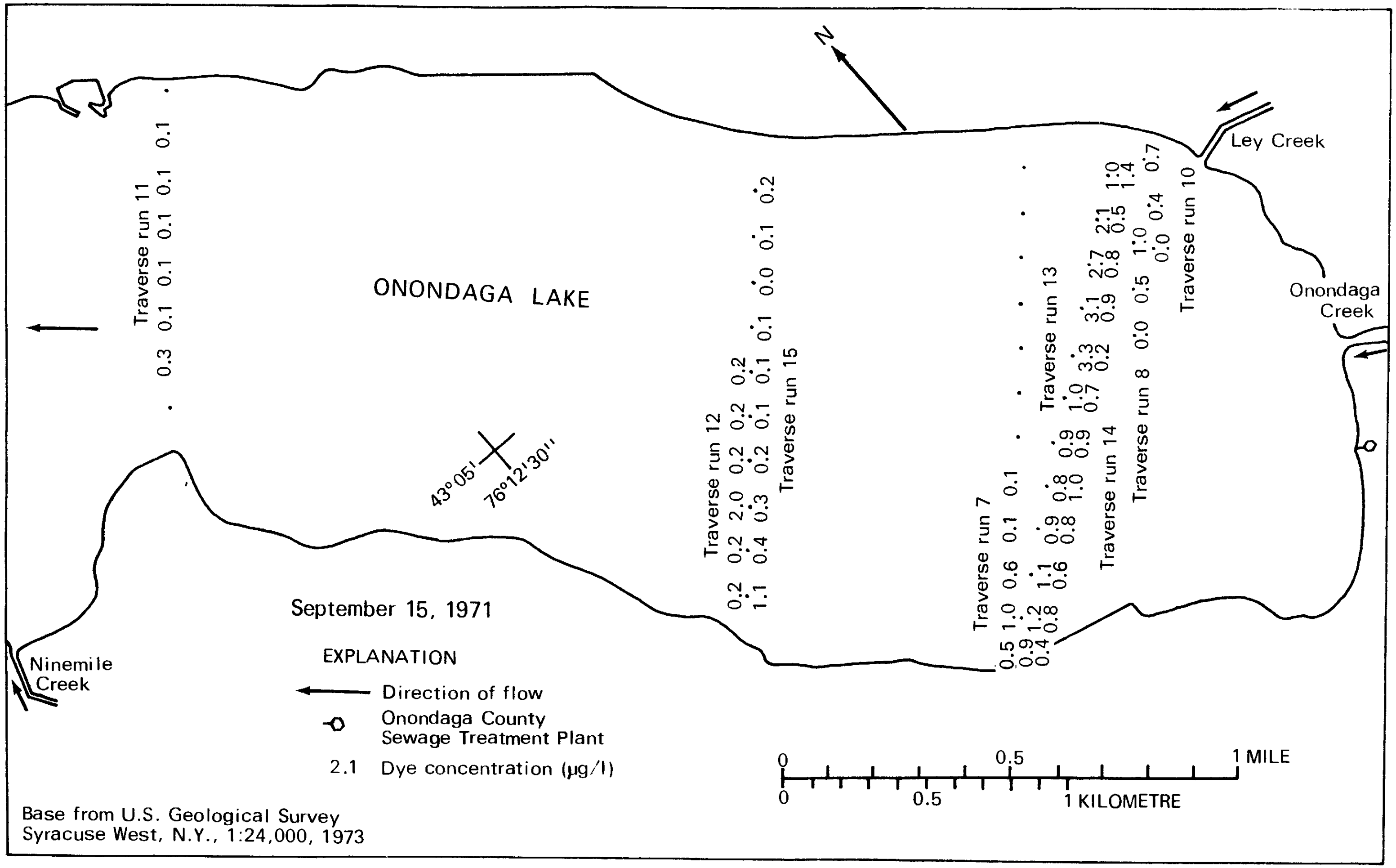


Figure 66.--Dye concentration (μg/l) found during traverse runs on part of Onondaga Lake during dye-dispersion study, September 15, 1971.

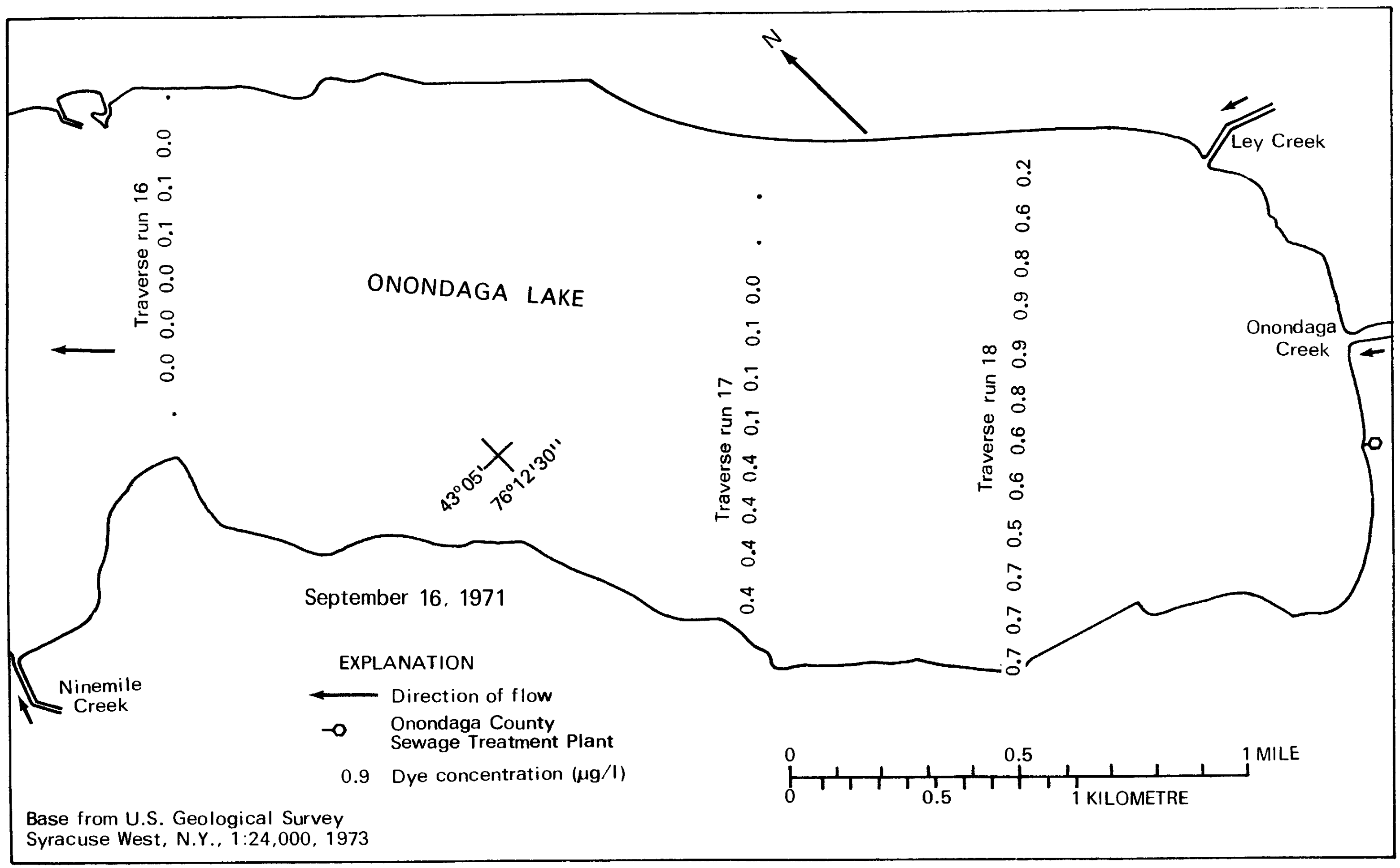


Figure 67.--Dye concentration (µg/l) found during traverse runs on part of Onondaga Lake during dye-dispersion study, September 16, 1971.

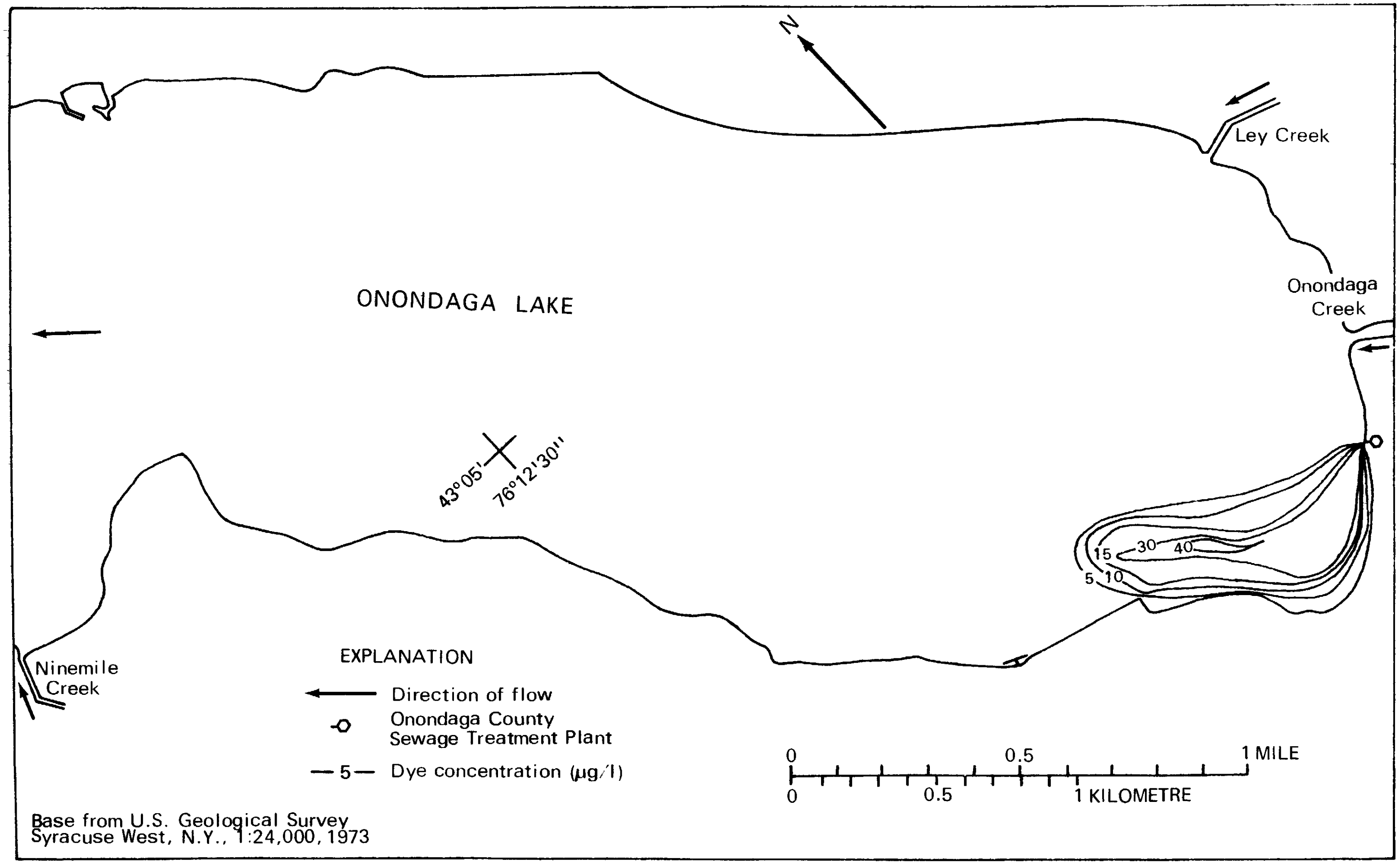


Figure 68.--Lines of equal dye concentration on part of Onondaga Lake about 9 hours after dye was injected at Onondaga County Sewage Treatment Plant at 07.17 hours, September 14, 1971.

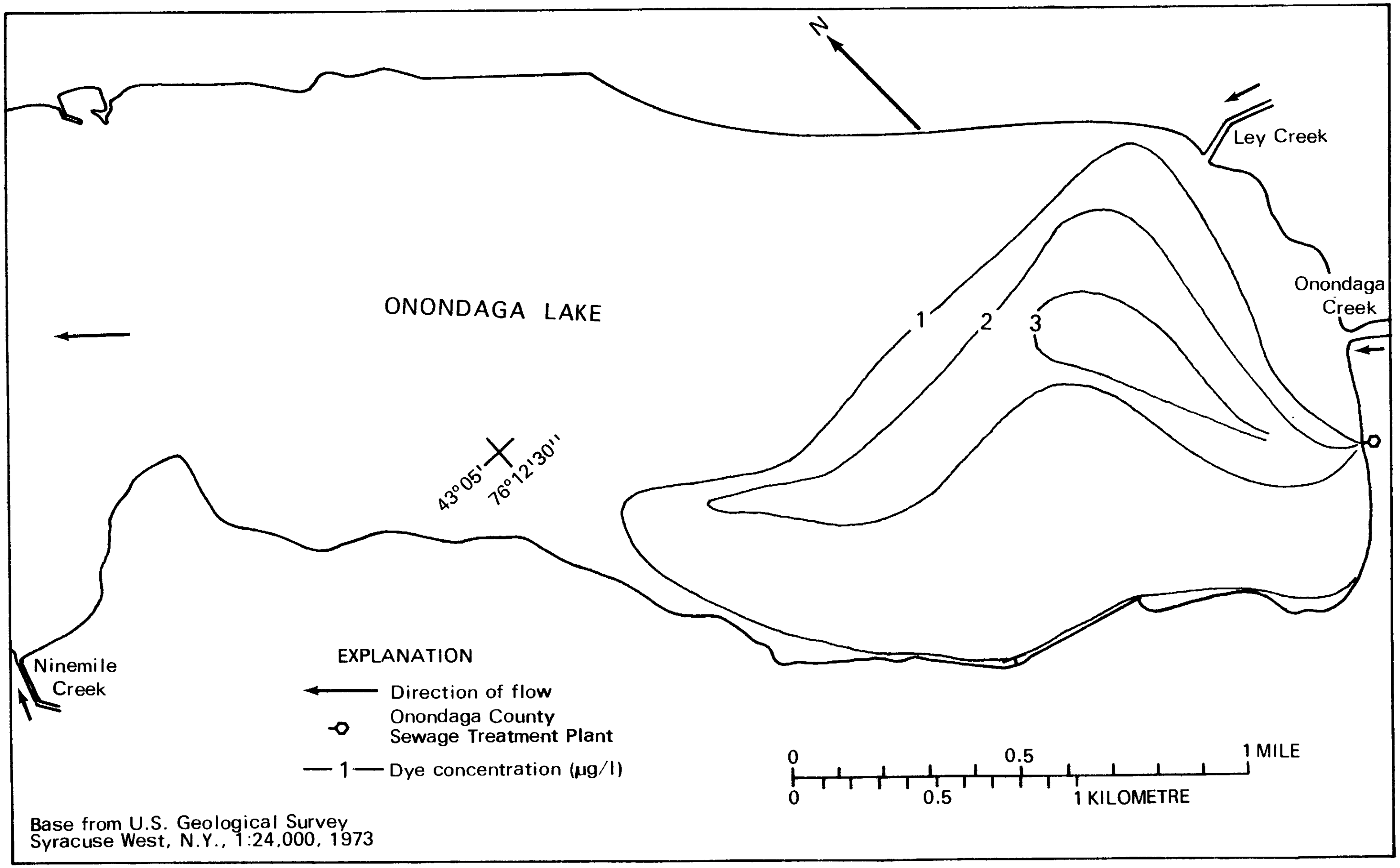


Figure 69.--Lines of equal dye concentration on part of Onondaga Lake about 33 hours after dye was injected at Onondaga County Sewage Treatment Plant at 07.17 hours, September 14, 1971.

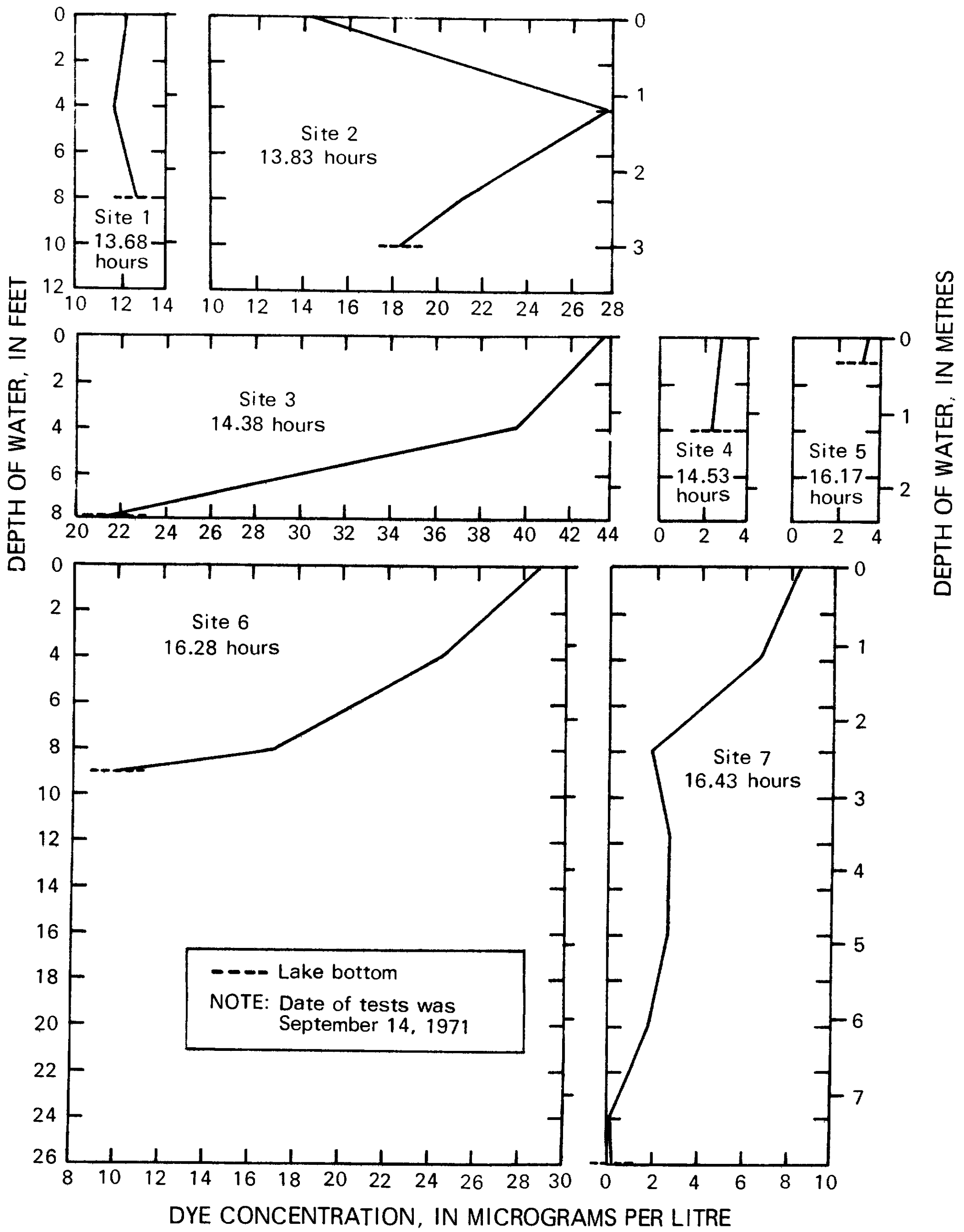


Figure 70.--Depth concentration curves for several sampling sites on Onondaga Lake, September 14, 1971.

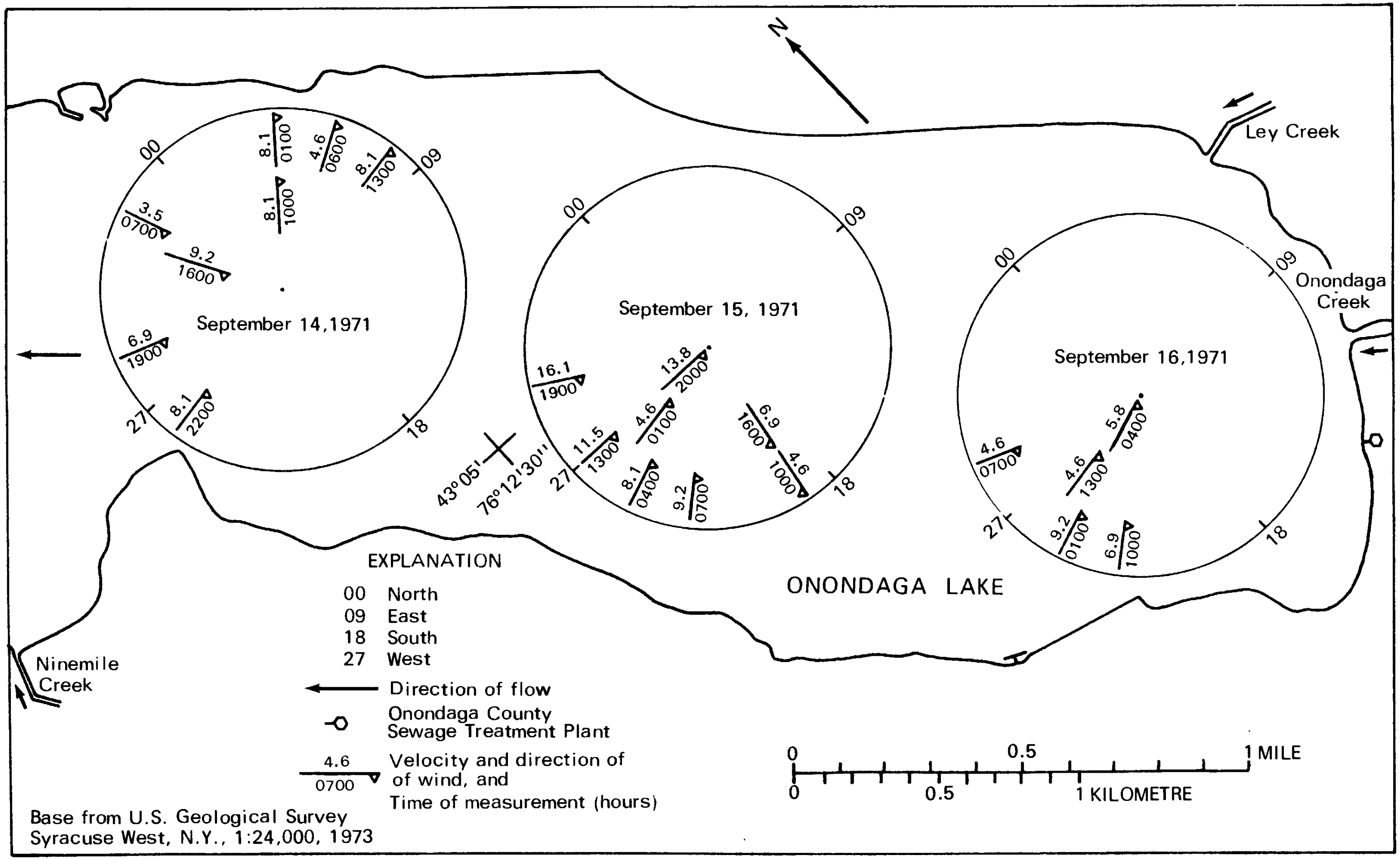


Figure 71.--Onondaga Lake with wind direction as recorded by U.S. Department of Commerce, National Oceanic and Atmospheric Administration, at Hancock Airport near Syracuse, September 14-16, 1971.

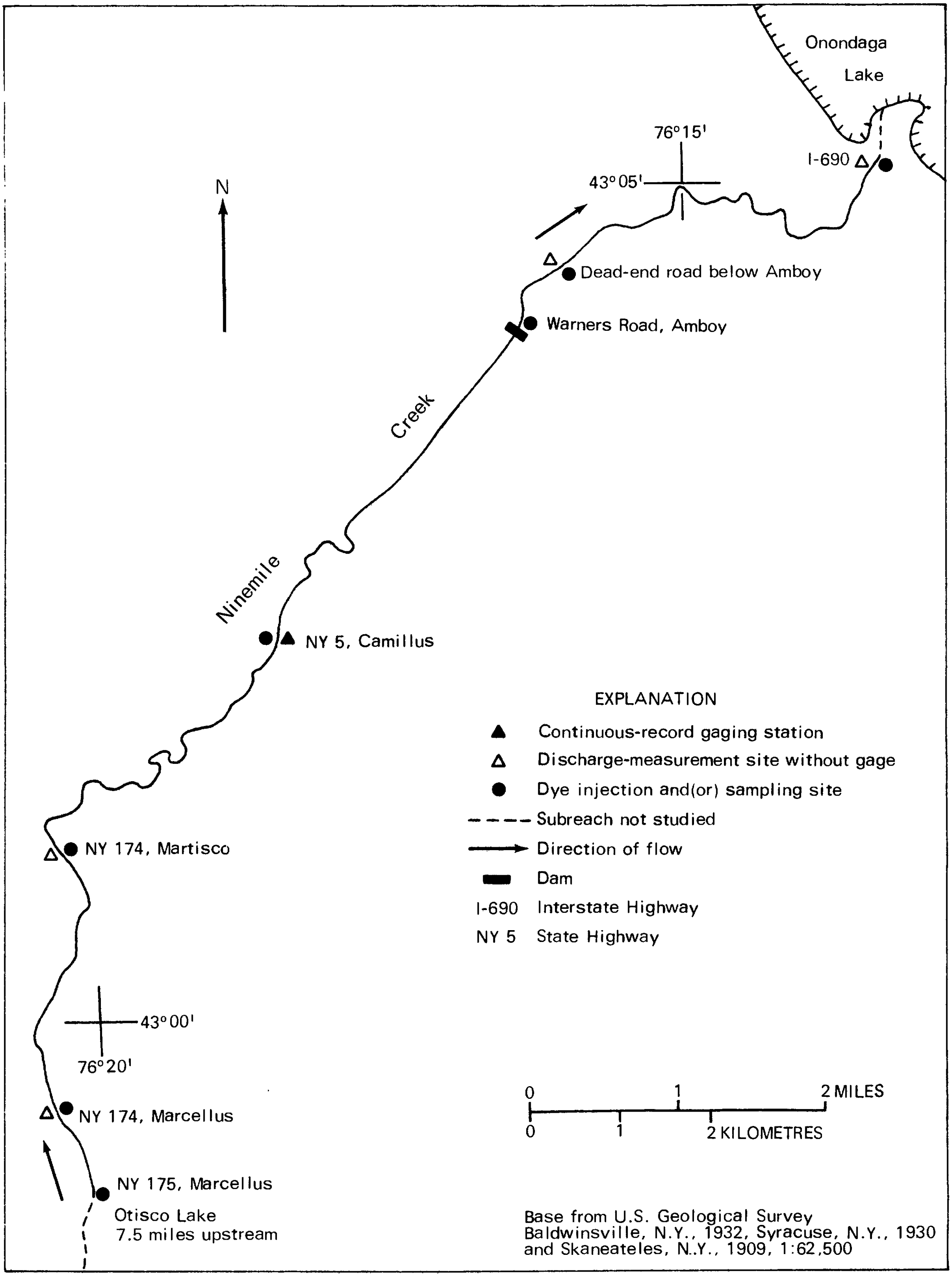


Figure 72.--Location of study reach, subreaches, gaging station, and measurement sites on Ninemile Creek.

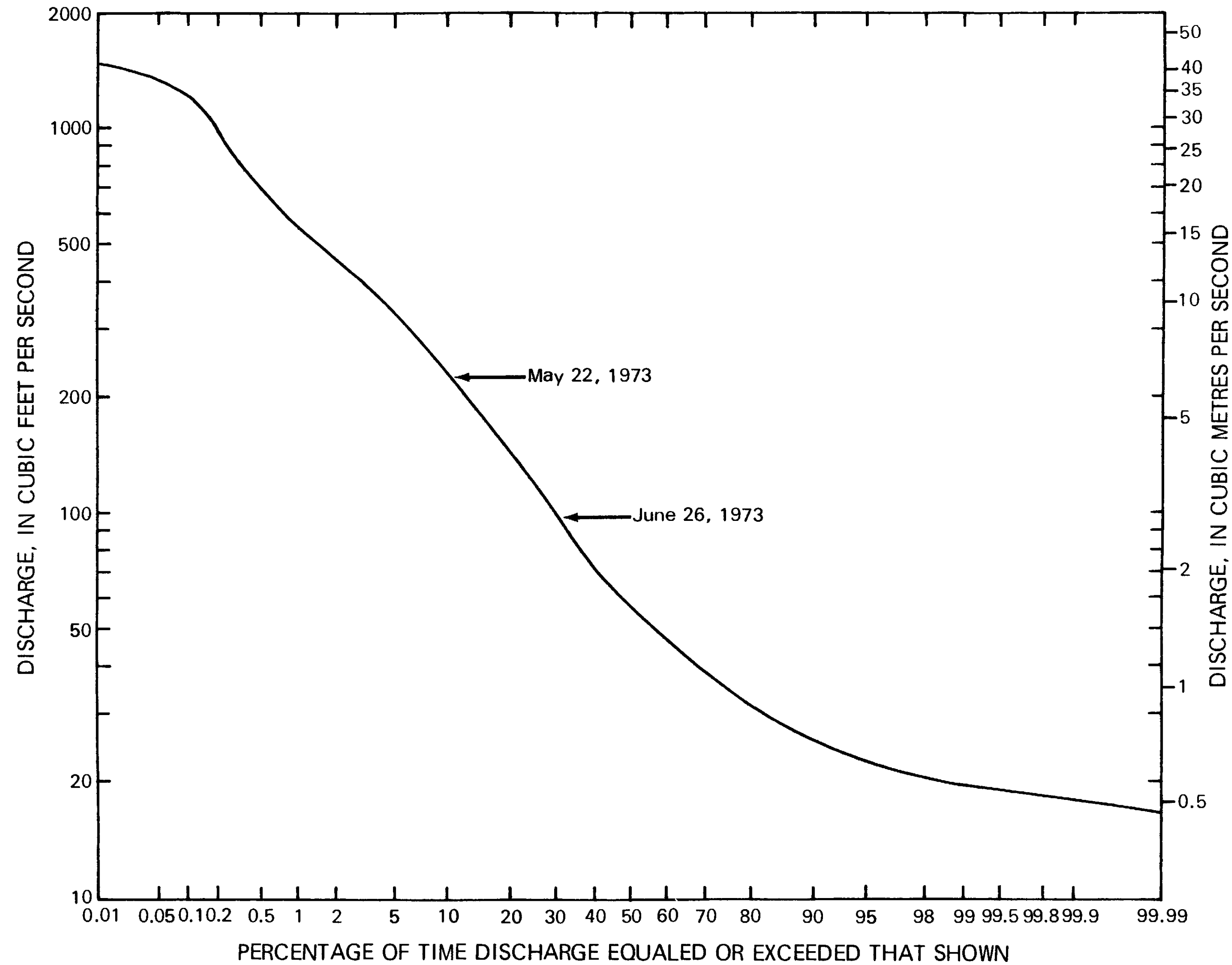


Figure 73.--Duration curves of daily mean flows for Ninemile Creek at Camillus (1959-72).

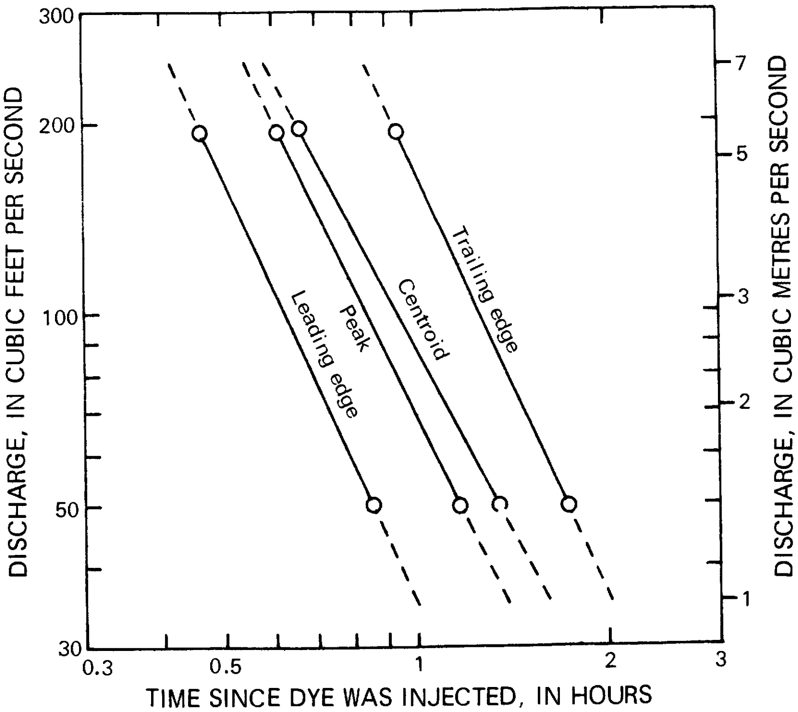


Figure 74.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ninemile Creek: State Highway 175 at Marcellus to State Highway 174 at Marcellus.

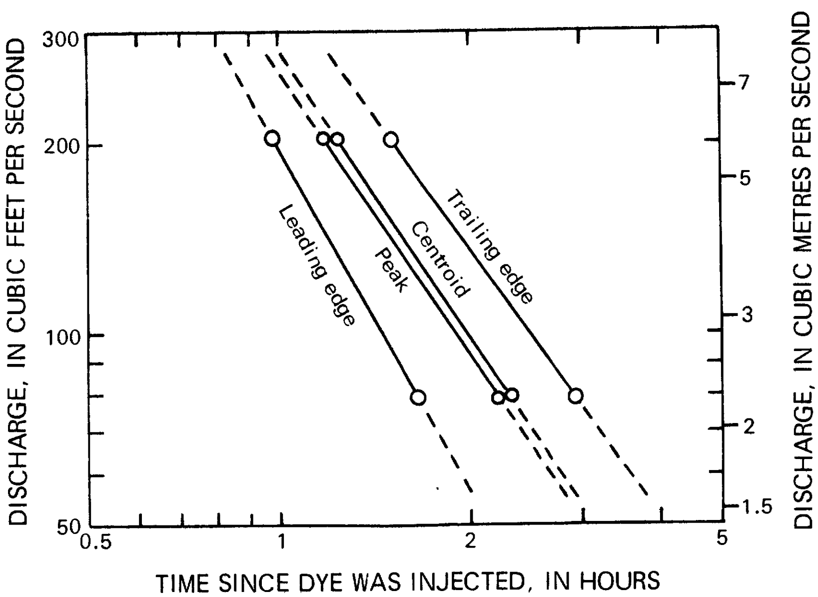


Figure 75.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ninemile Creek: State Highway 174 at Marcellus to State Highway 174 at Martisco.

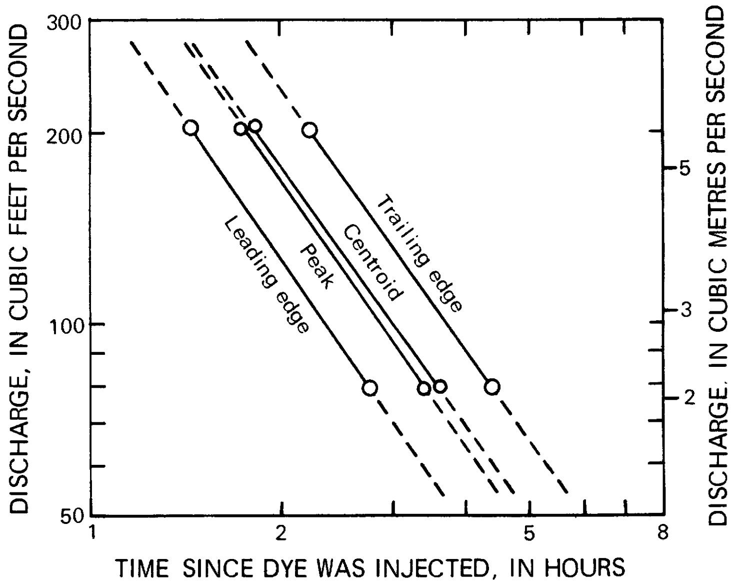


Figure 76.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ninemile Creek: State Highway 175 at Marcellus to State Highway 174 at Martisco.

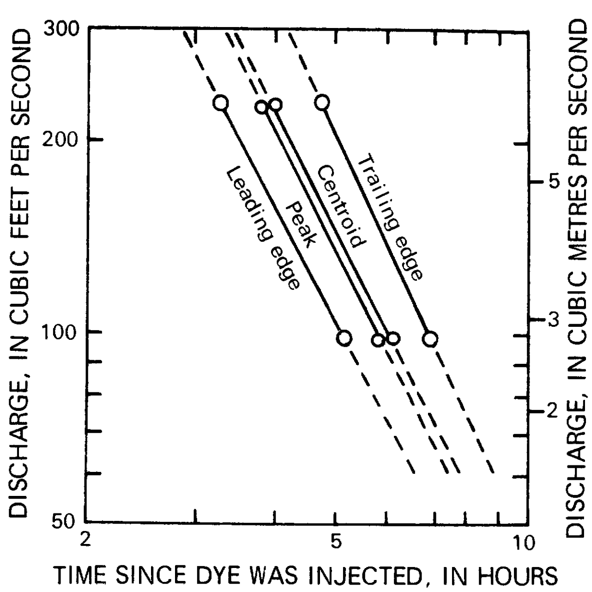


Figure 77.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ninemile Creek: State Highway 174 at Martisco to State Highway 5 at Camillus.

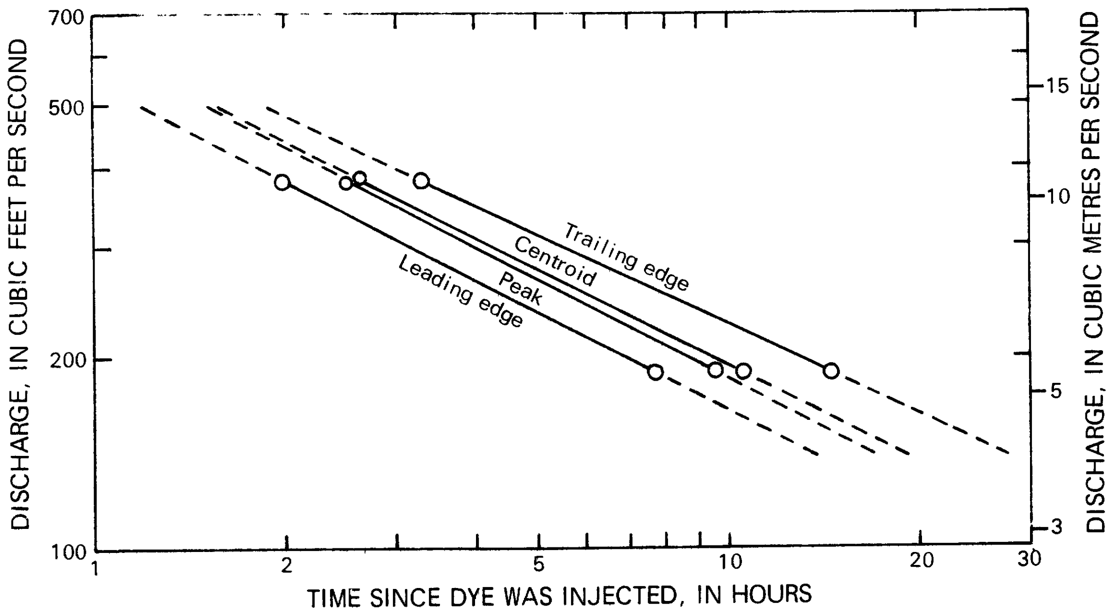


Figure 78.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Ninemile Creek: dead-end road below Amboy to Interstate Highway 690 at Lakeland.

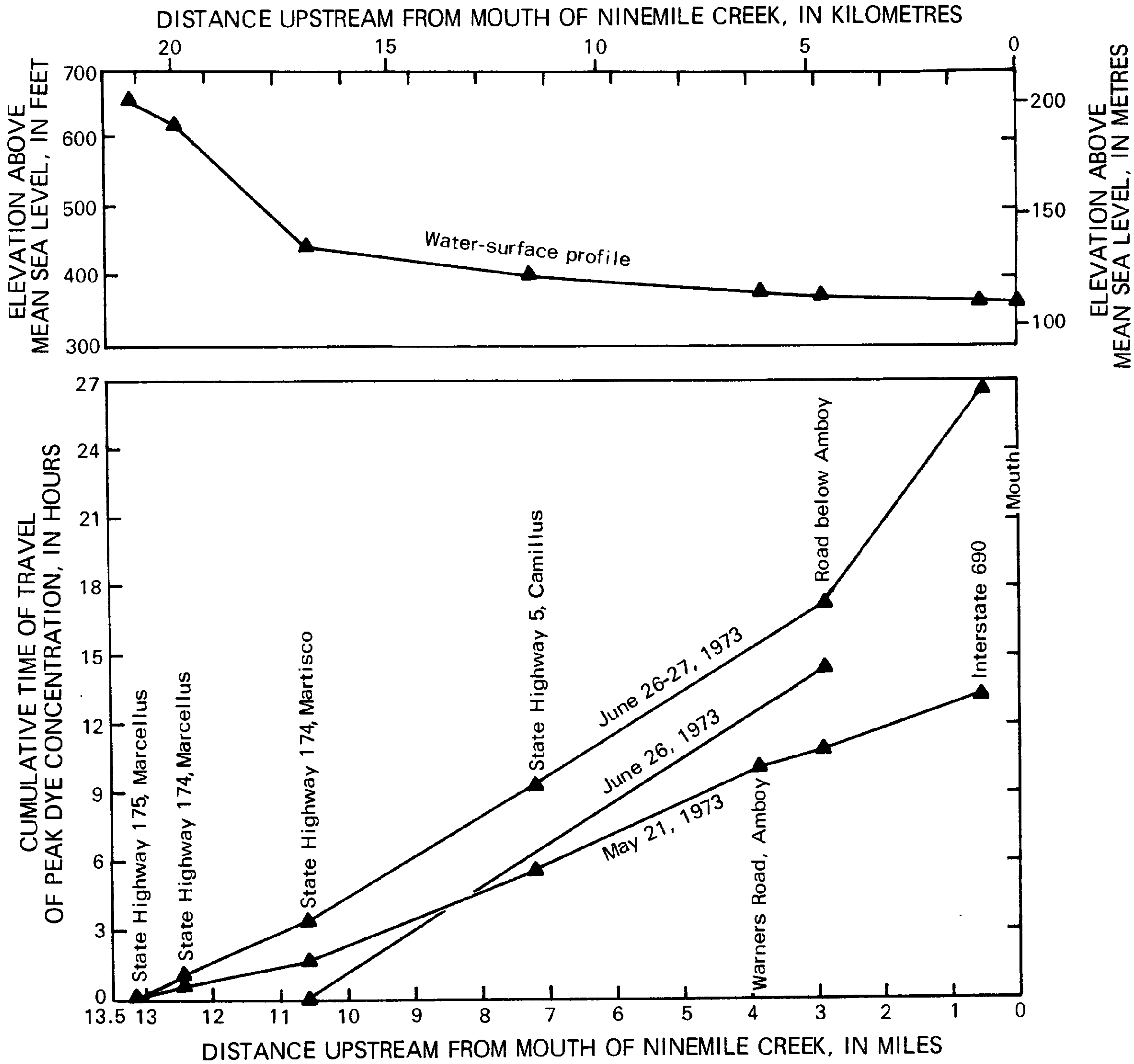


Figure 79.--Water-surface profile and cumulative time of travel of peak dye concentration for Ninemile Creek: State Highway 175 at Marcellus to Interstate Highway 690 at Lakeland.

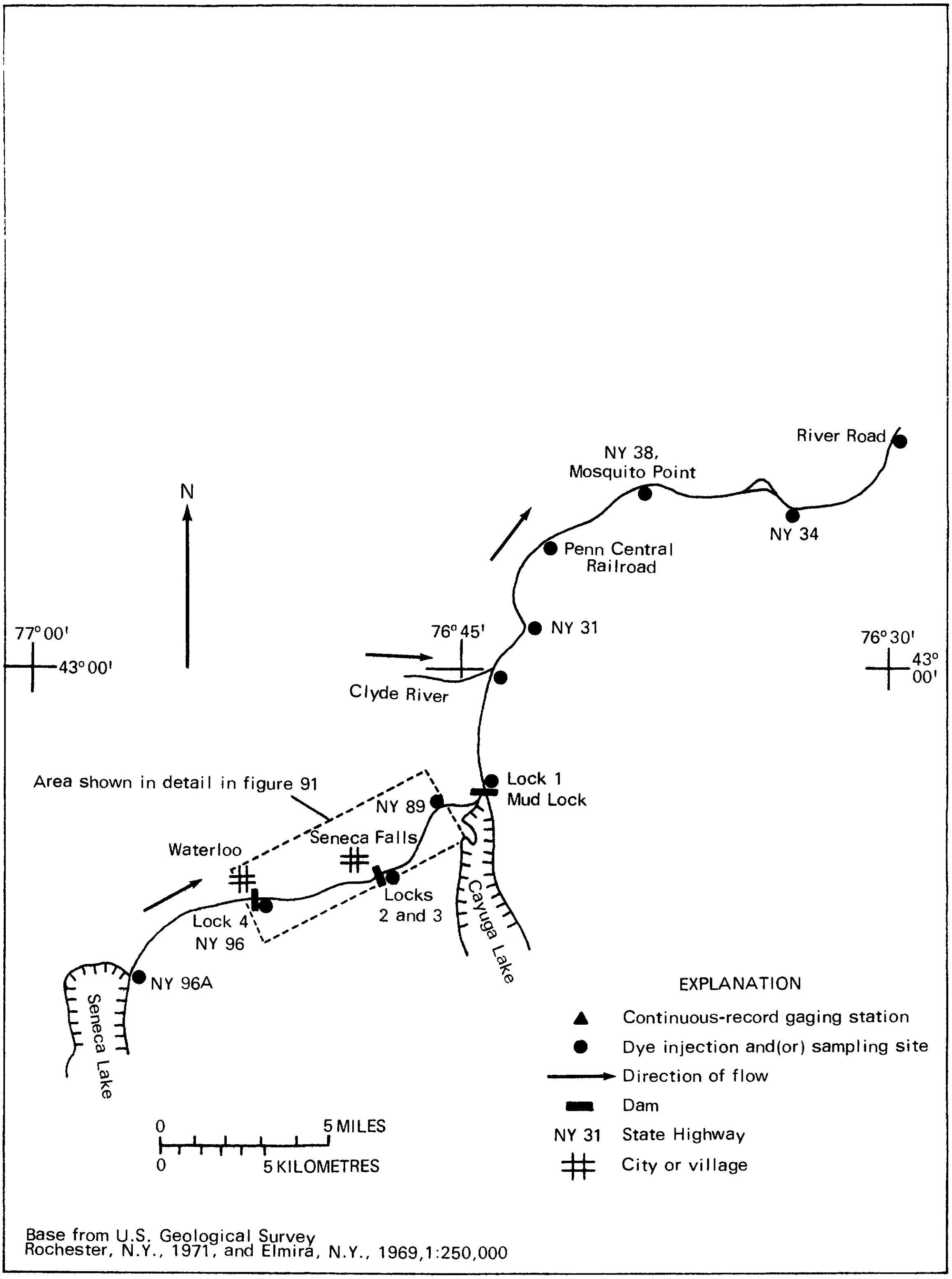
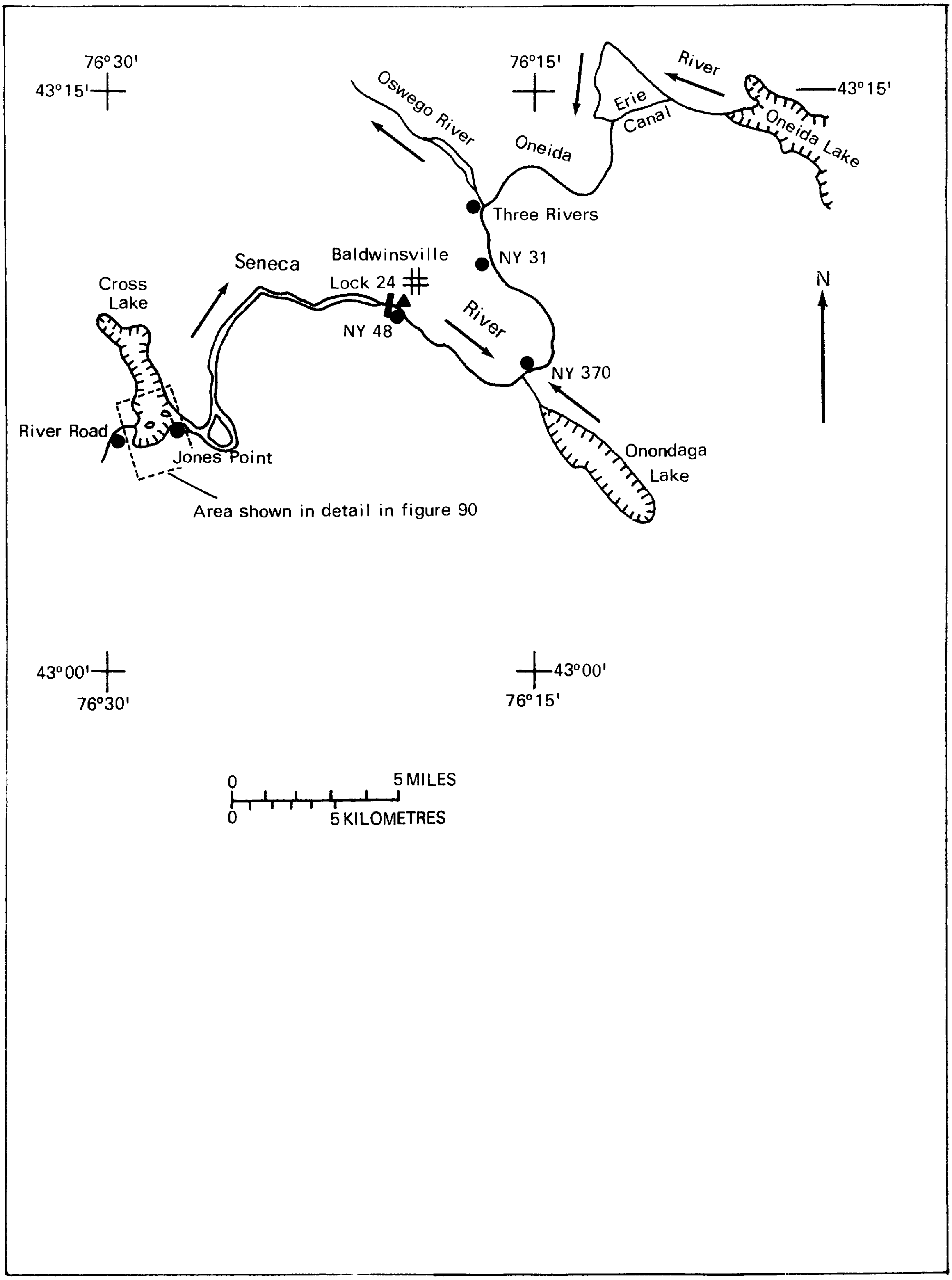
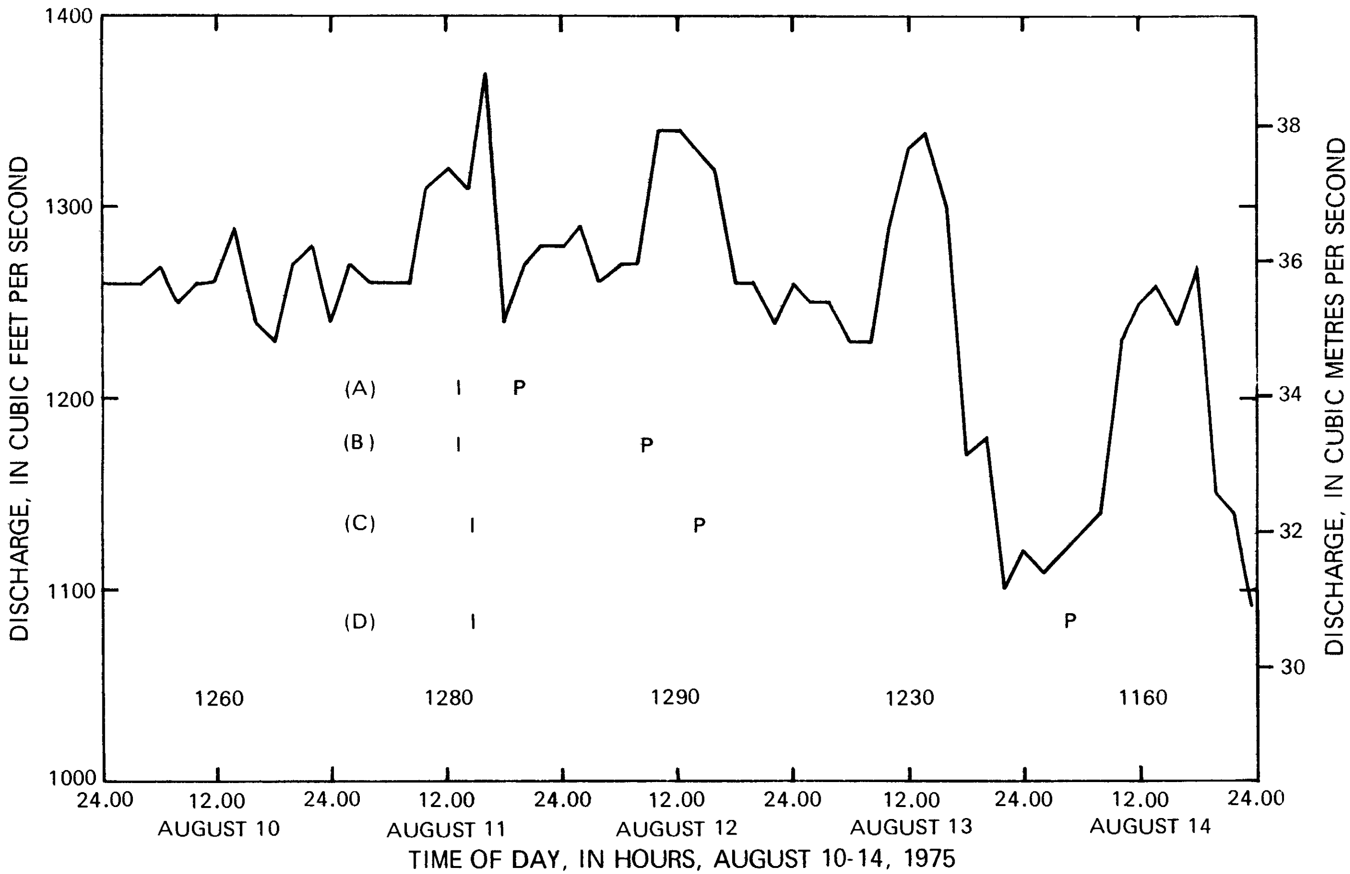


Figure 80.--Location of reach, subreaches, gaging station,



and measurement sites on Seneca River.



EXPLANATION

(A) - State Highway 31 to Three Rivers
(B) - State Highway 370 to State Highway 31
(C) - State Highway 48 to State Highway 370
(D) - Jones Point to State Highway 48
I - Time dye was injected
P - Time of peak dye concentration
1260 - Mean daily discharge, in ft^3/s

Figure 81.--Variation in discharge with time at gaging station Seneca River at Baldwinsville for August 10-14, 1975.

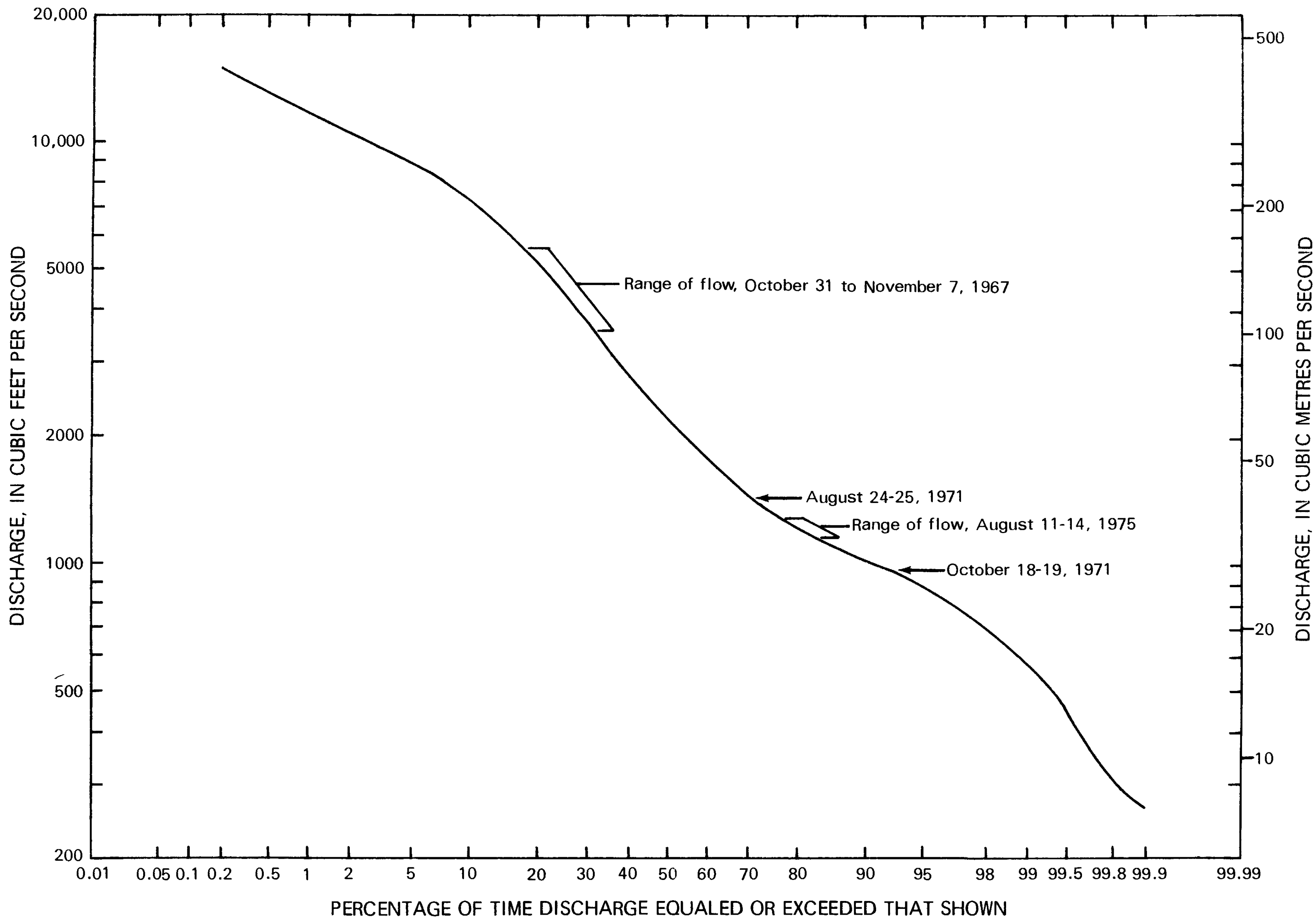


Figure 82.--Duration curve of daily mean flows for Seneca River at Baldwinsville.

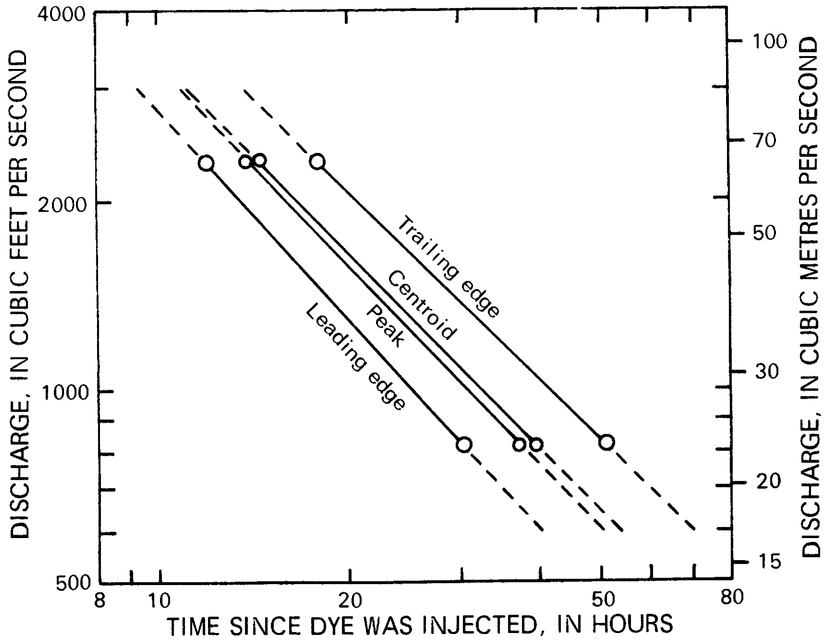


Figure 83.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: Penn Central Railroad to State Highway 34.

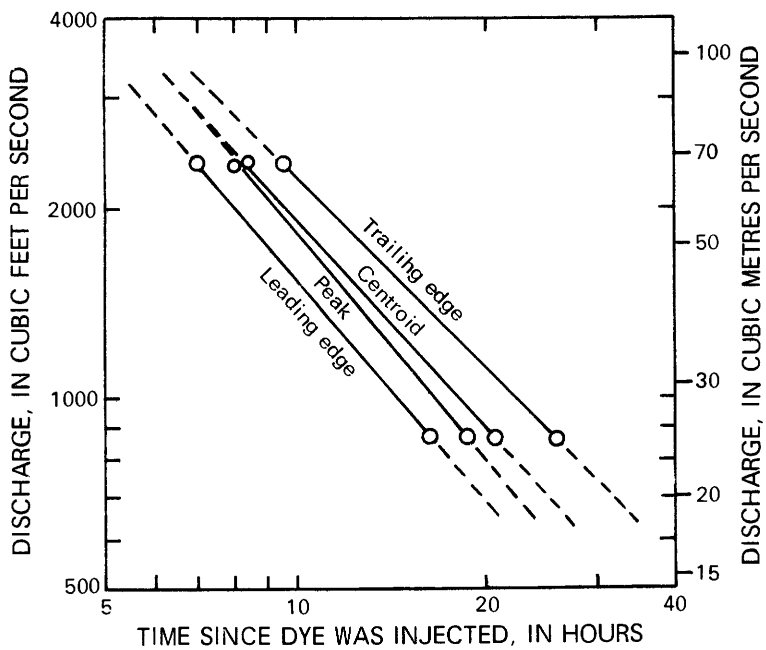


Figure 84.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: State Highway 34 to River Road.

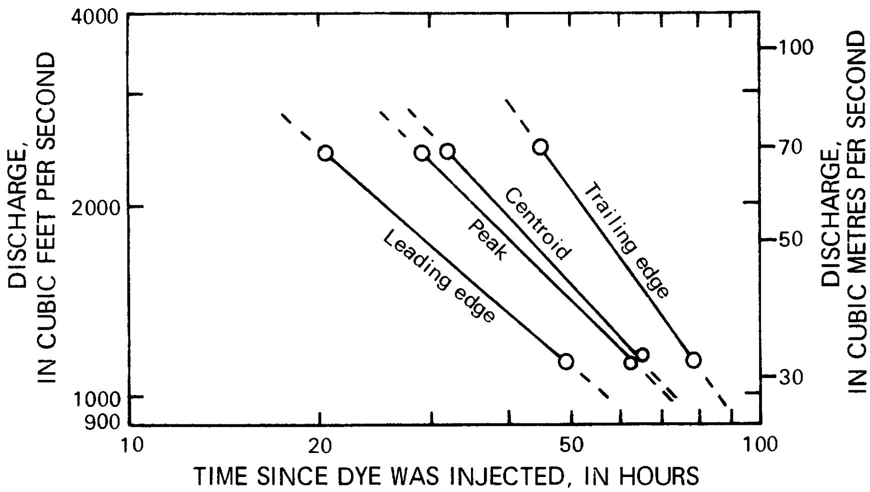


Figure 85.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: Jones Point to State Highway 48.

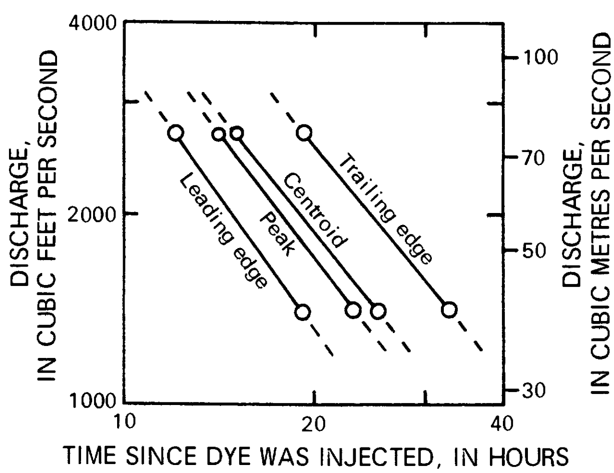


Figure 86.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: State Highway 48 to State Highway 370.

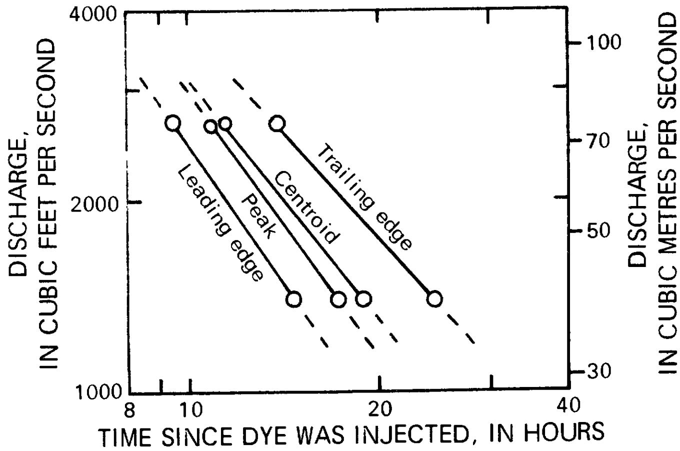


Figure 87.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: State Highway 370 to State Highway 31.

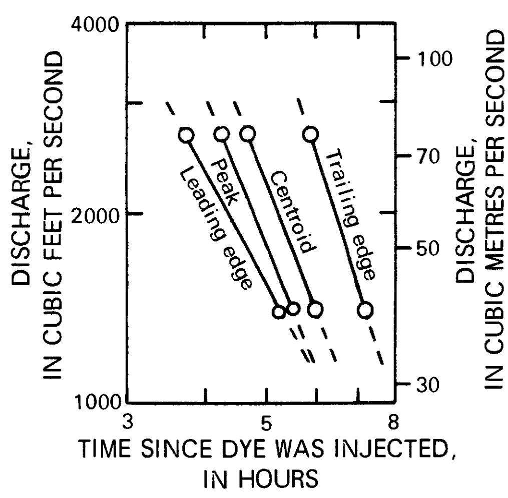


Figure 88.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Seneca River: State Highway 31 to Three Rivers.

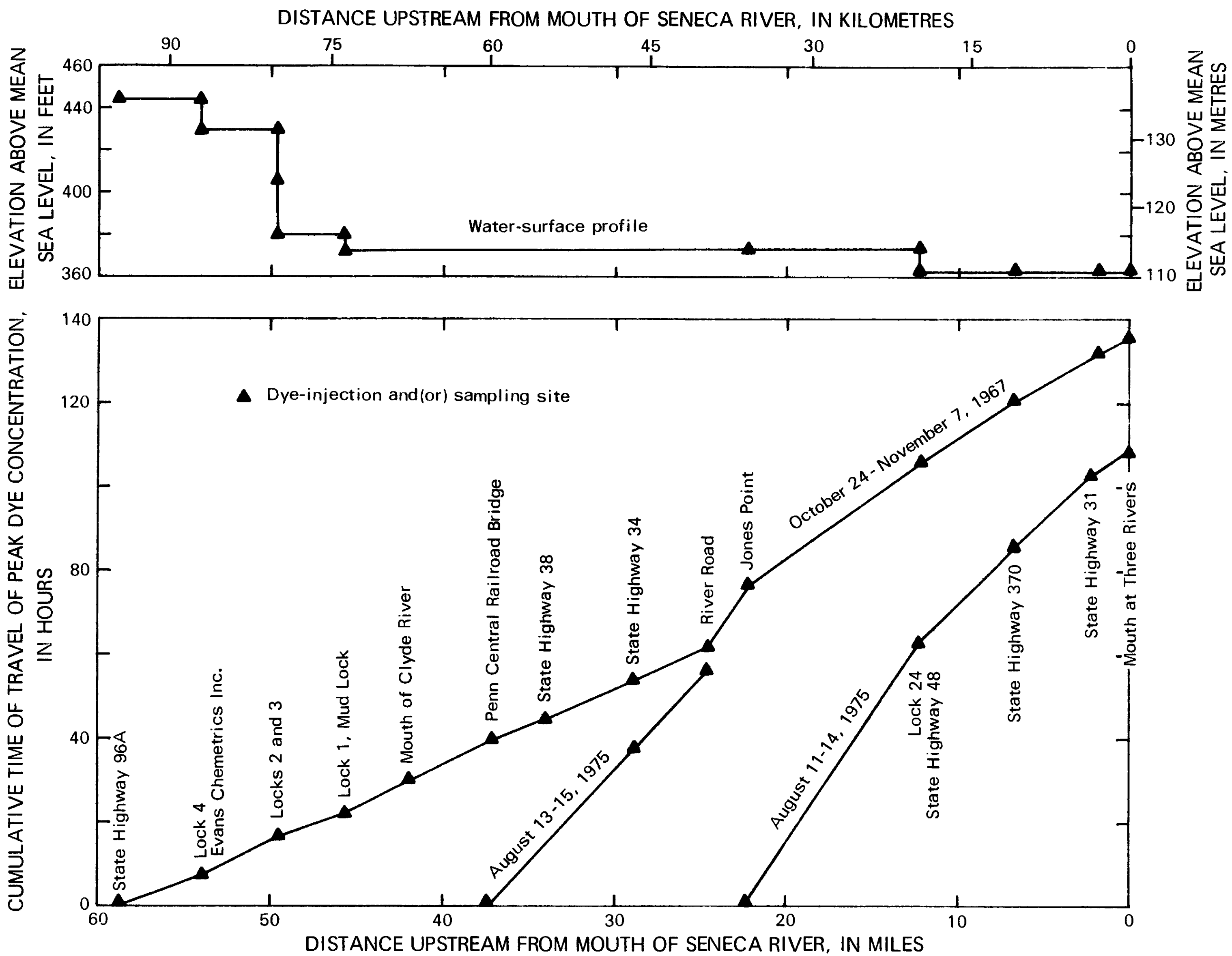


Figure 89.--Water-surface profile and cumulative time of travel of peak dye concentration for Seneca River: State Highway 96A at Geneva to mouth at Three Rivers.

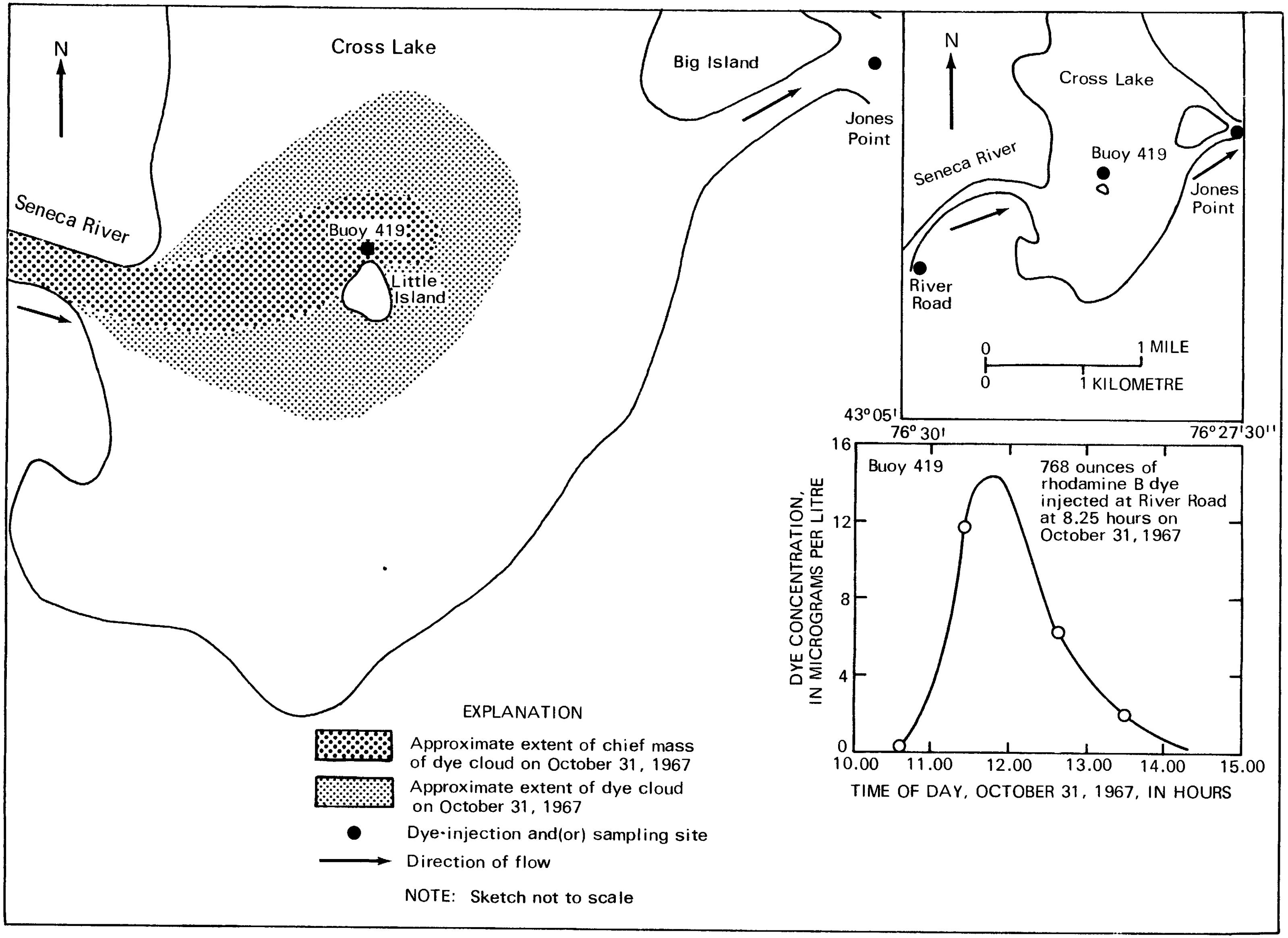


Figure 90.--Initial dye flow into Cross Lake from dye injection at River Road on Seneca River. Inset map shows dye concentrations at sampling site in μg/L.

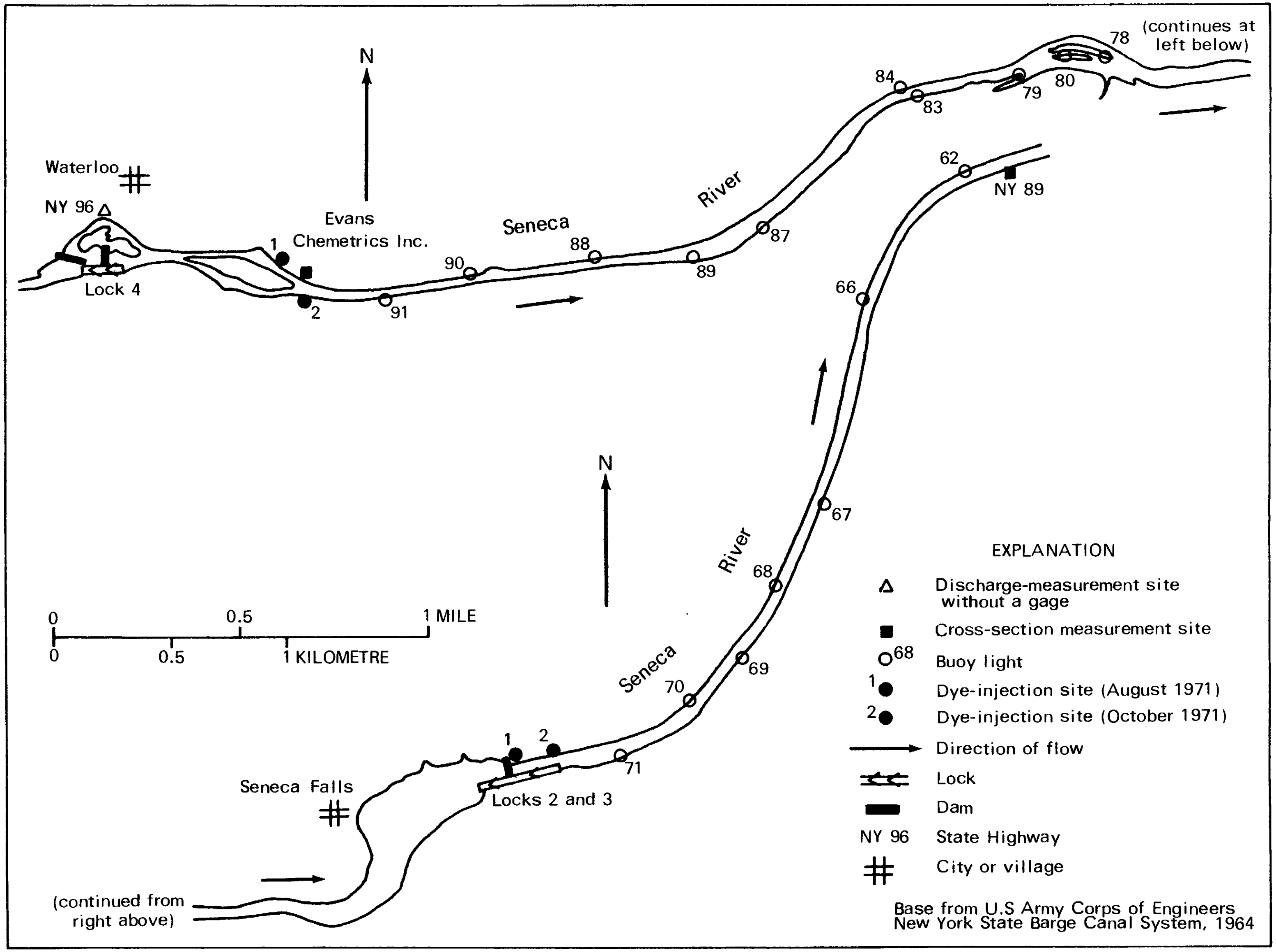


Figure 91.--Location of 1971 studies on Seneca River (Canal).

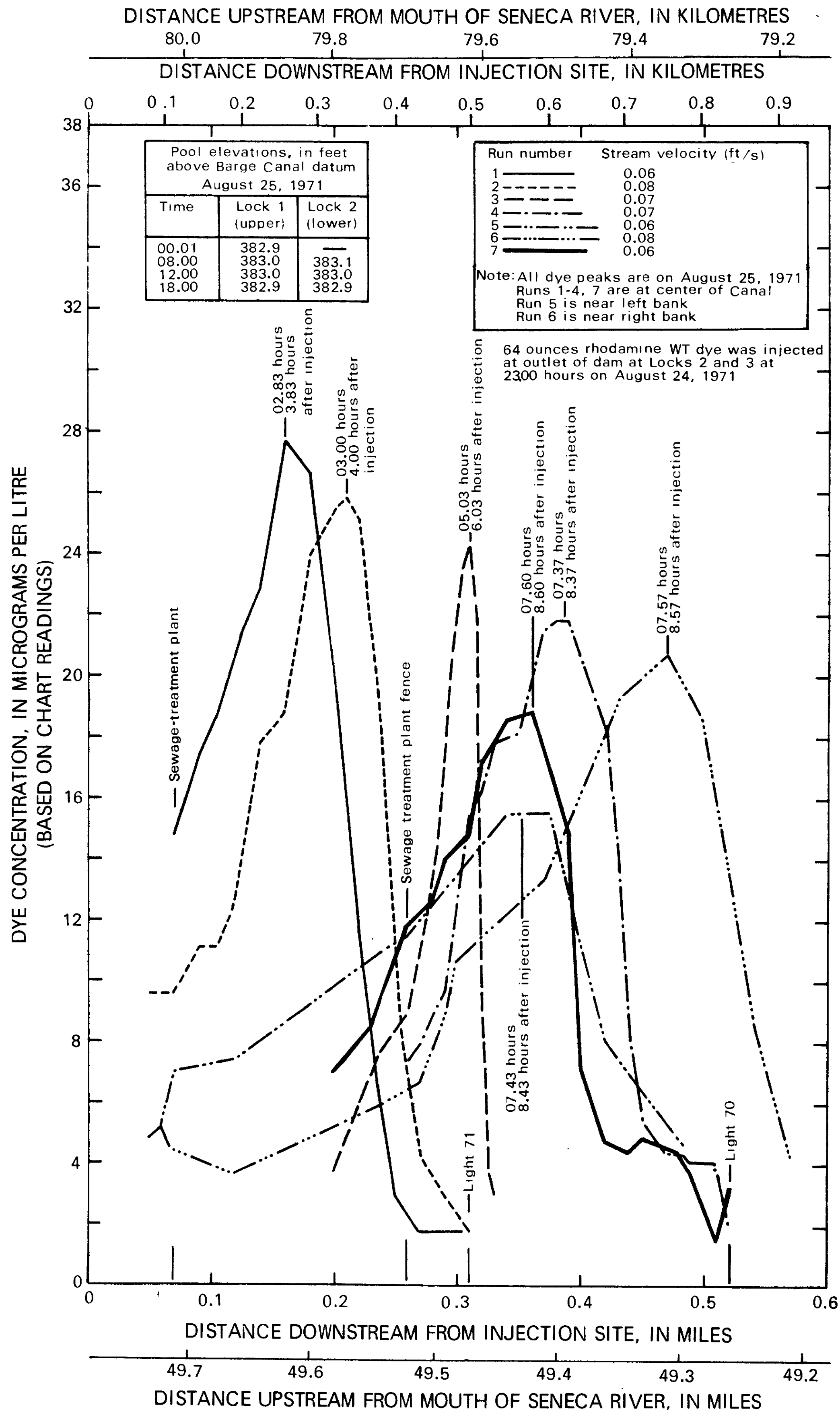


Figure 92.--Relation of observed dye concentration to distance traveled on Seneca River (Canal) in subreach 2 at Seneca Falls, August 24-25, 1971.

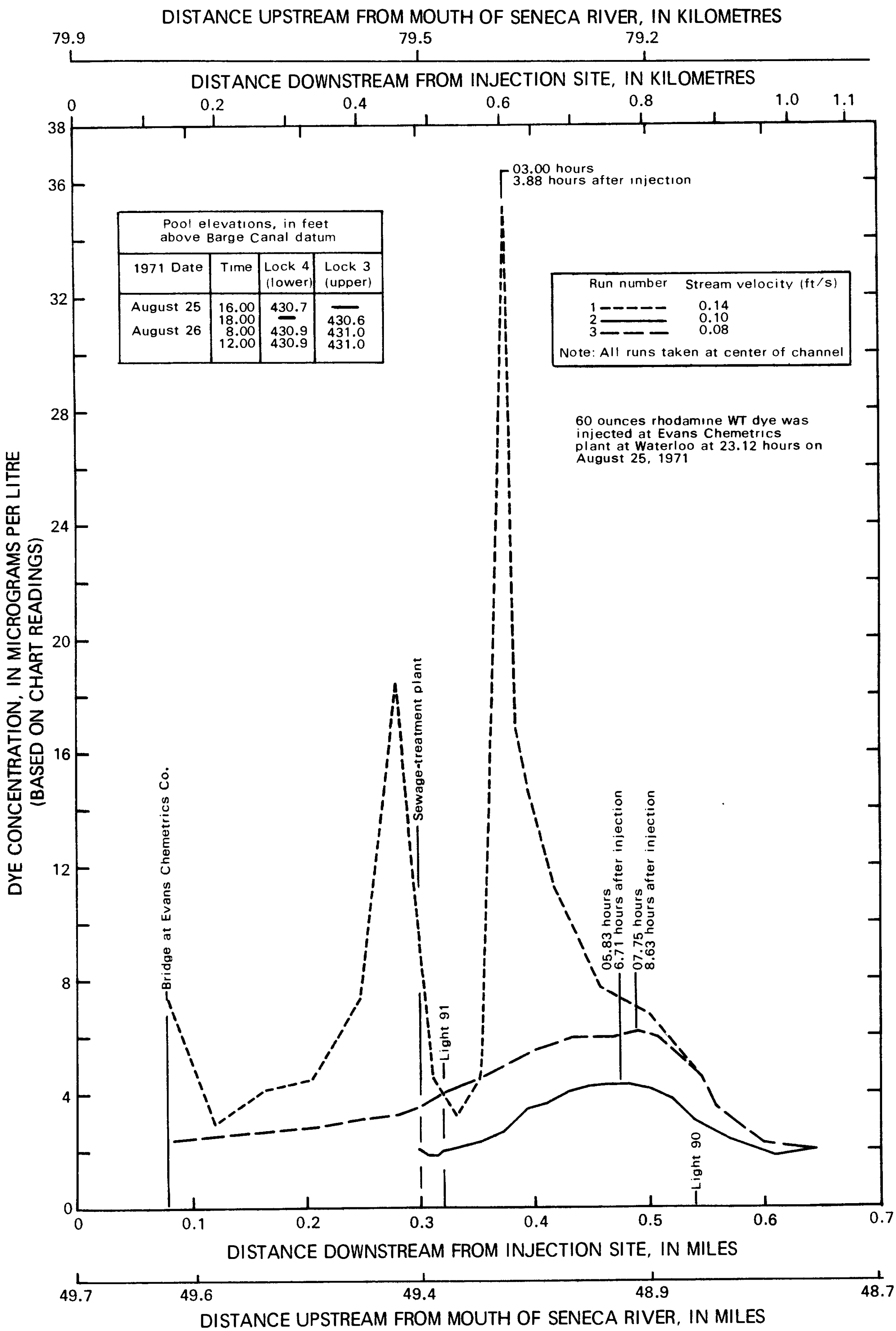


Figure 93.--Relation of observed dye concentration to distance traveled on Seneca River (Canal) in subreach 1 at Waterloo, August 25-26, 1971.

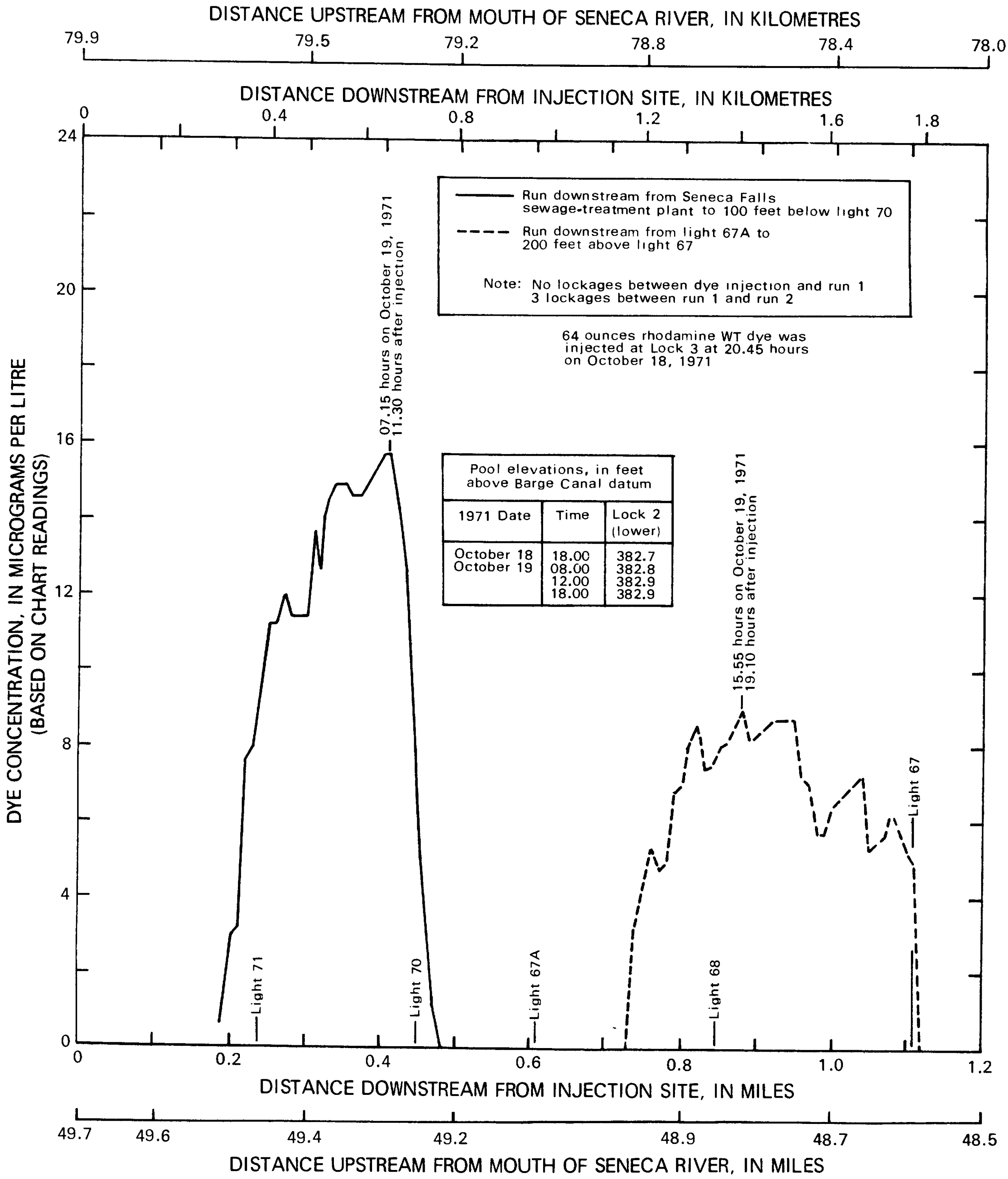


Figure 94.--Relation of observed dye concentration to distance traveled on Seneca River (Canal) in subreach 2 at Seneca Falls, October 18-19, 1971.

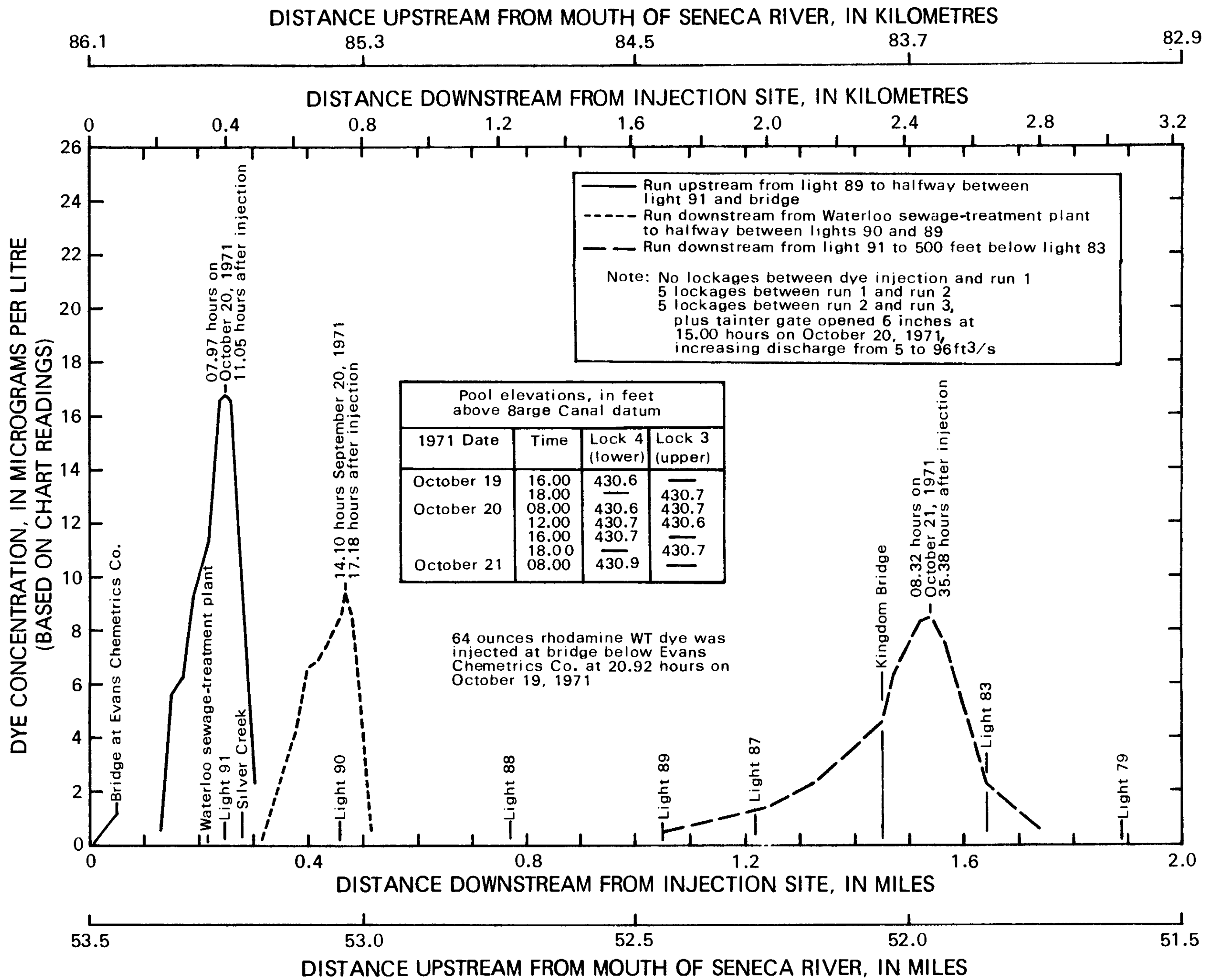


Figure 95.--Relation of observed dye concentration to distance traveled on Seneca River (Canal) in subreach 1 at Waterloo, October 19-21, 1971.

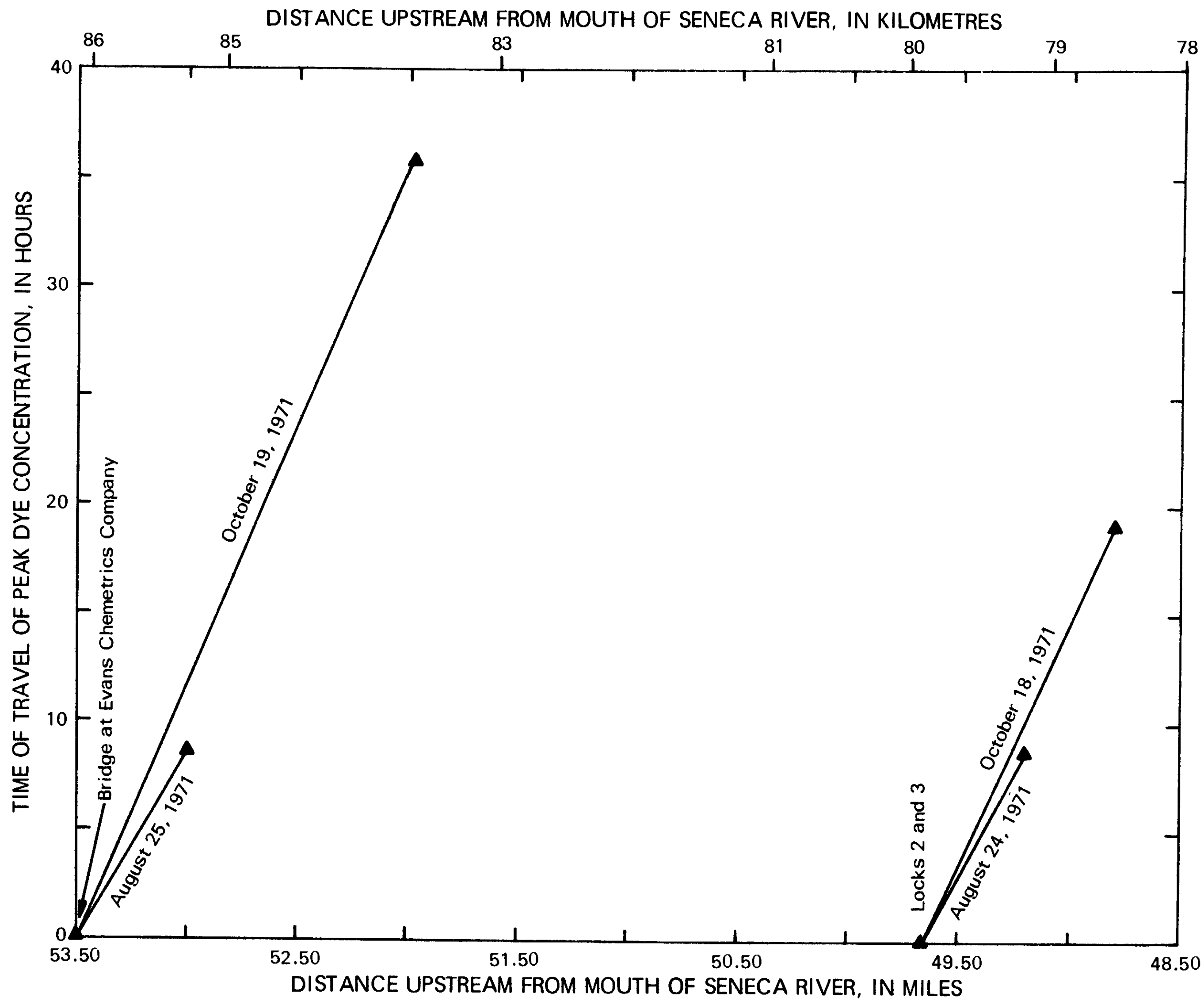


Figure 96.--Time of travel of peak dye concentration for Seneca River from dye injections at Lock 2 and Evans Chemetrics Co.

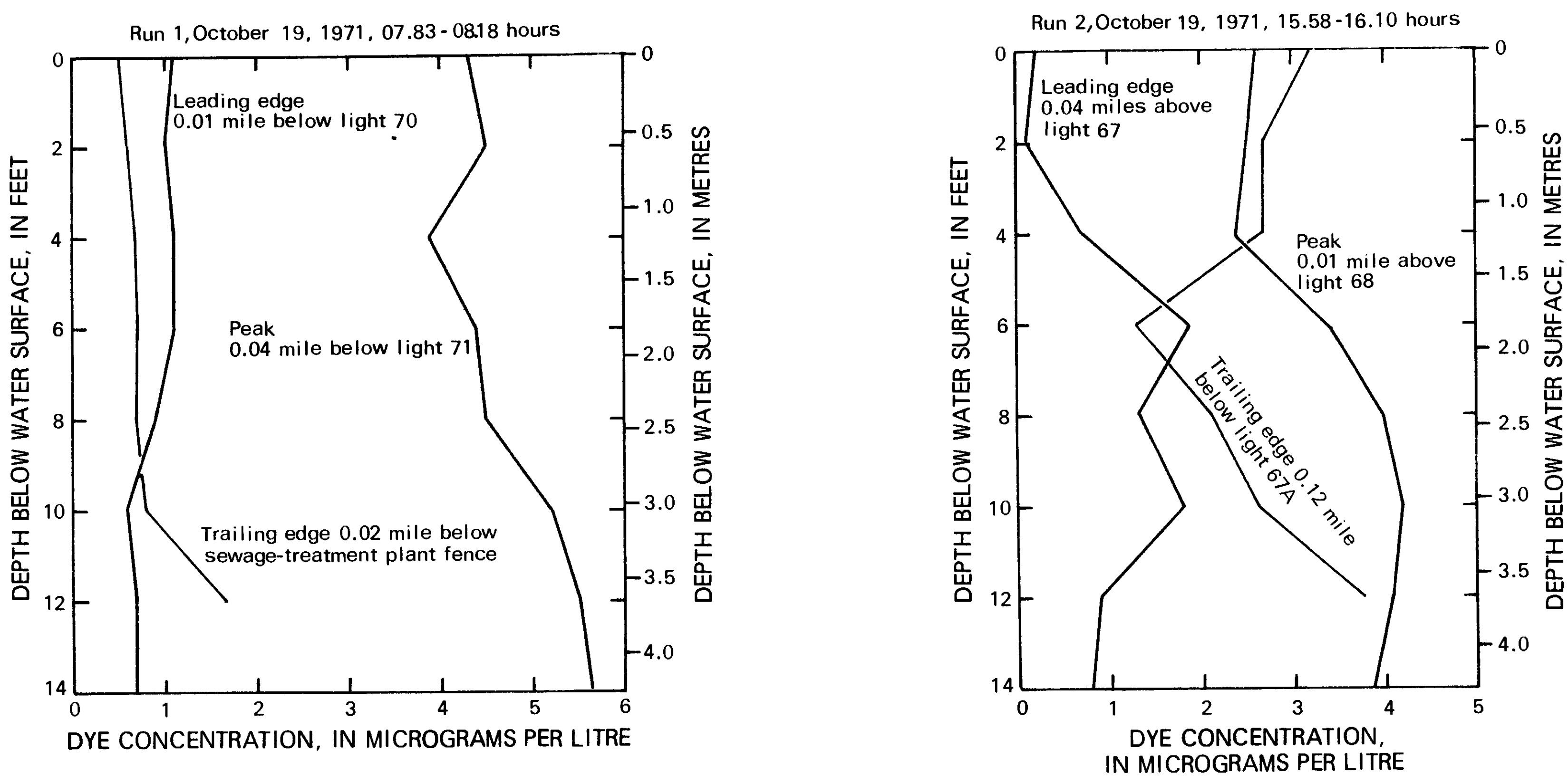


Figure 97.--Relation of dye concentration to depth of water at leading edge, peak, and trailing edge of dye cloud for Seneca River (Canal) in subreach 2 at Seneca Falls, October 19, 1971.

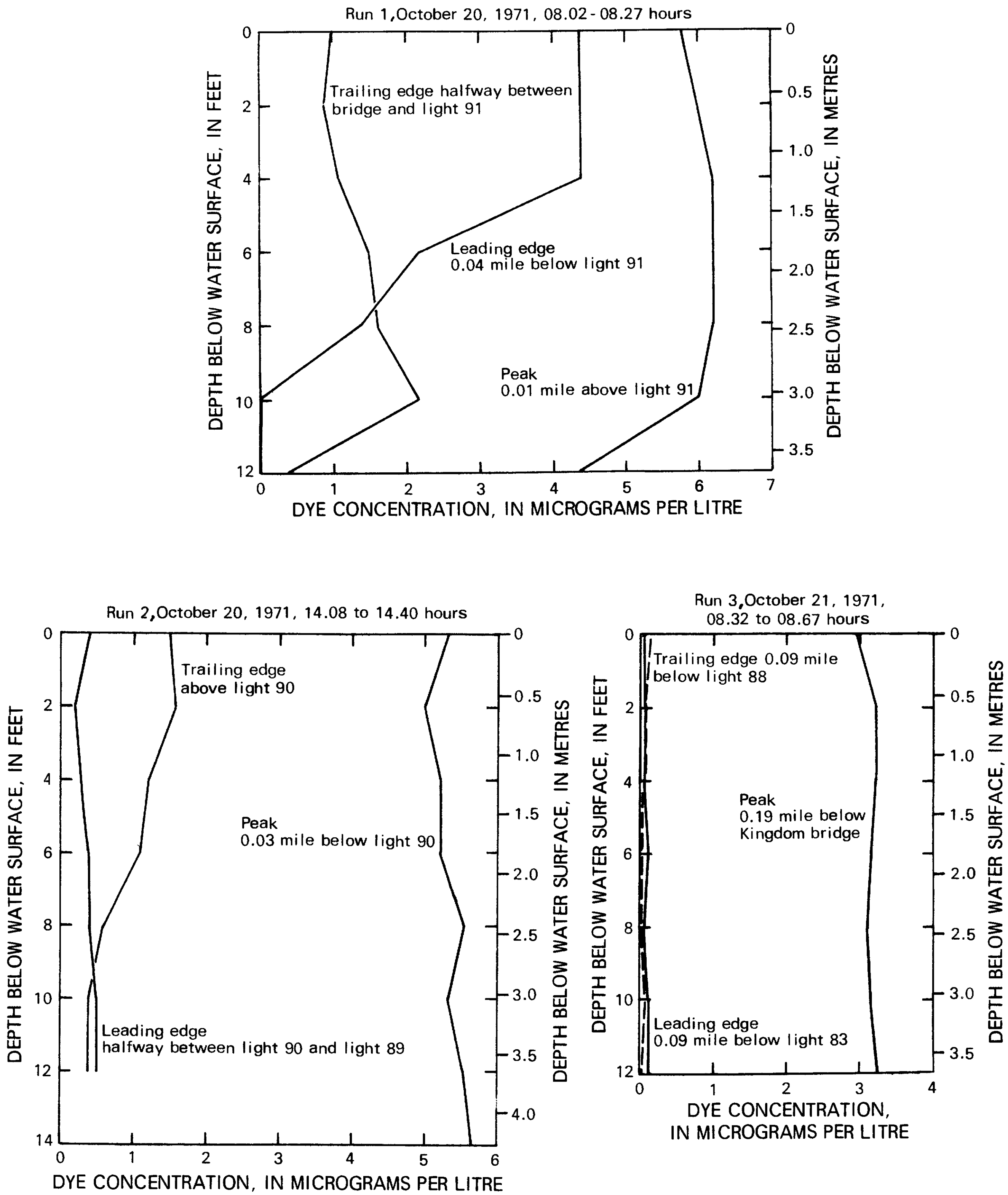


Figure 98.--Relation of dye concentration to depth of water at leading edge, peak, and trailing edge of dye cloud for Seneca River (Canal) in subreach 1 at Waterloo, October 20-21, 1971.

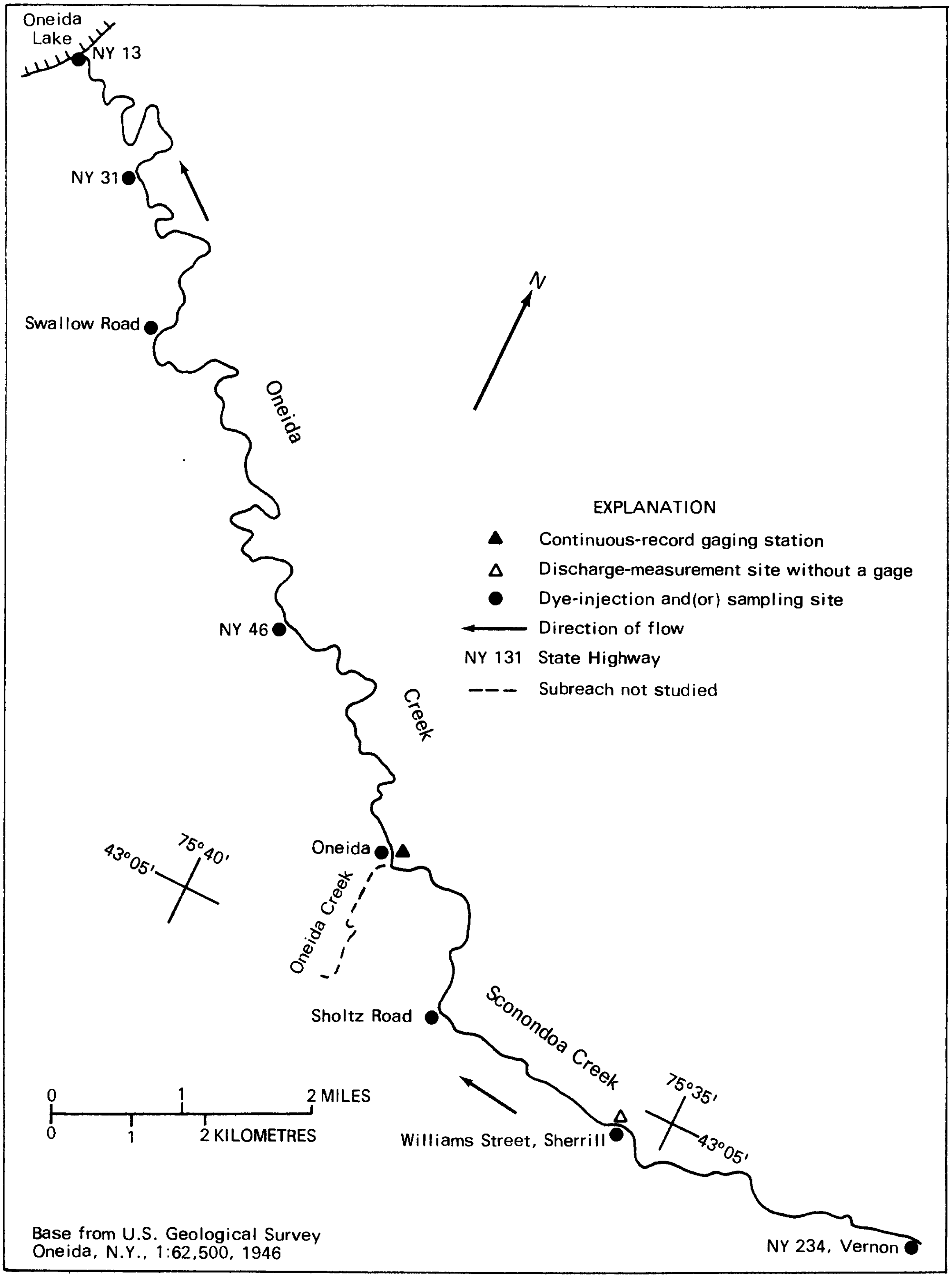


Figure 99.--Location of reach, subreaches, gaging station, and measurement sites in Oneida Creek basin.

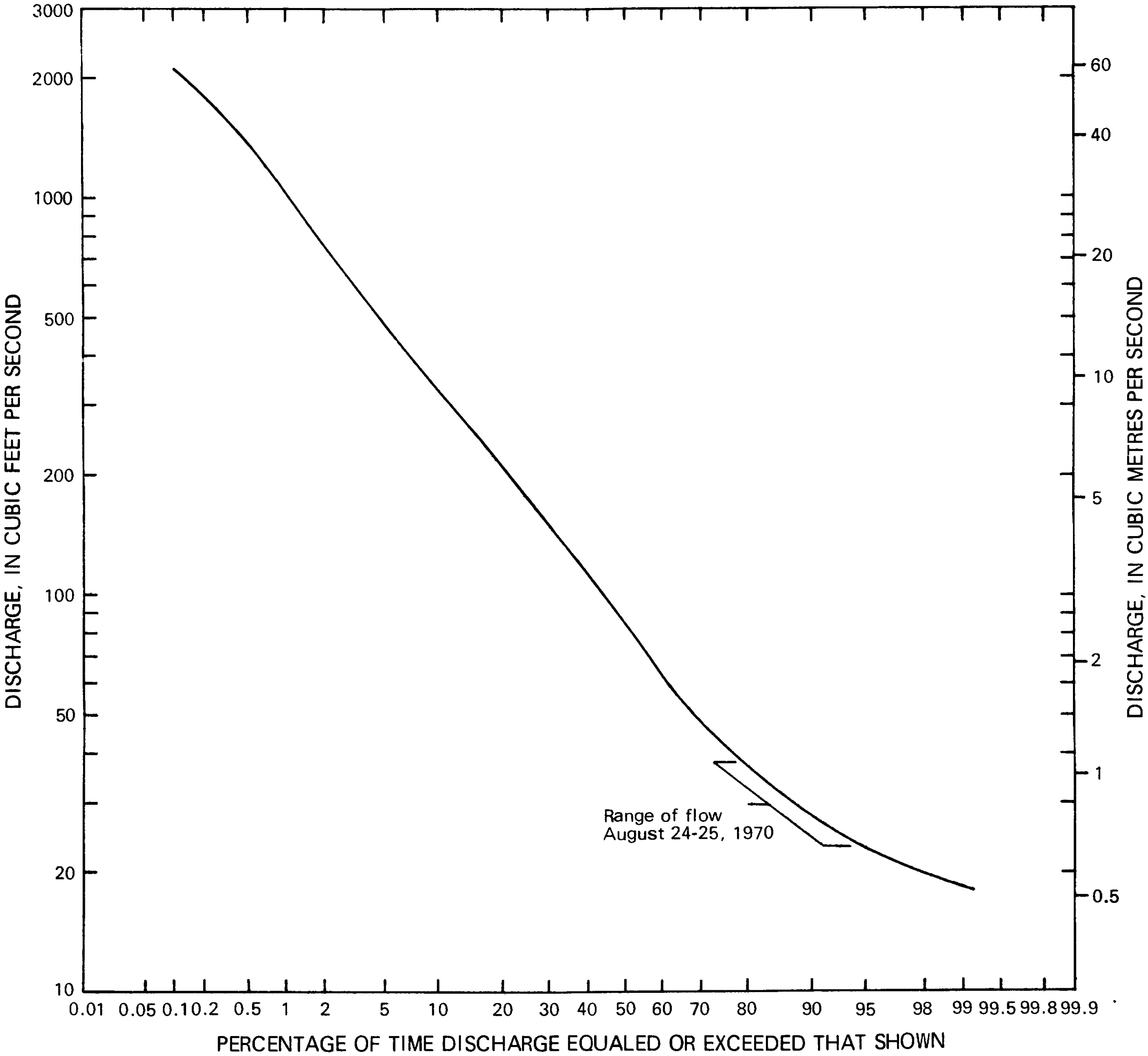


Figure 100.--Duration curve of daily mean flows for Oneida Creek at Oneida.

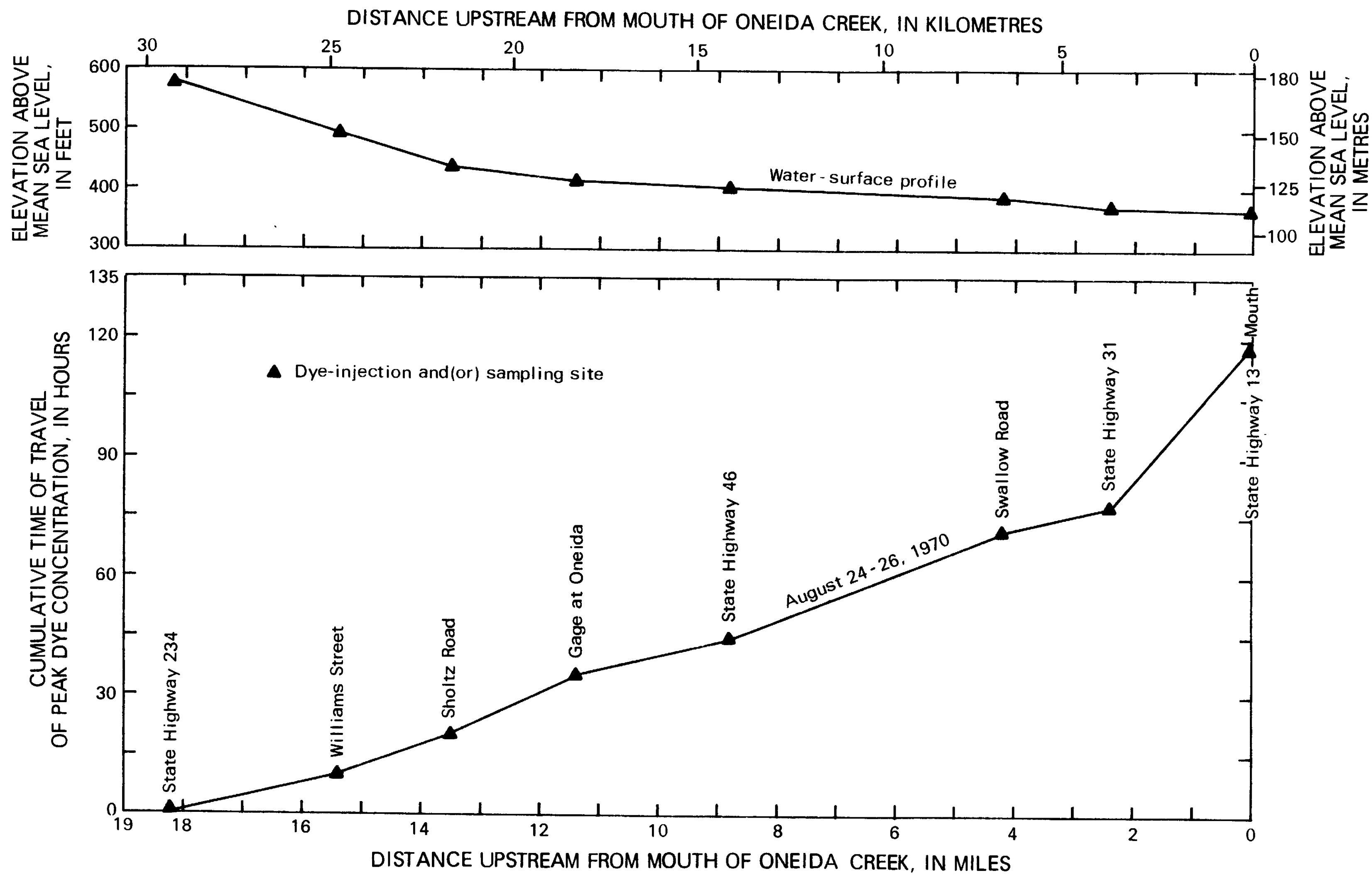


Figure 101.--Water-surface profile and cumulative time of travel of peak dye concentration for Oneida Creek basin: State Highway 234 at Vernon to State Highway 13.

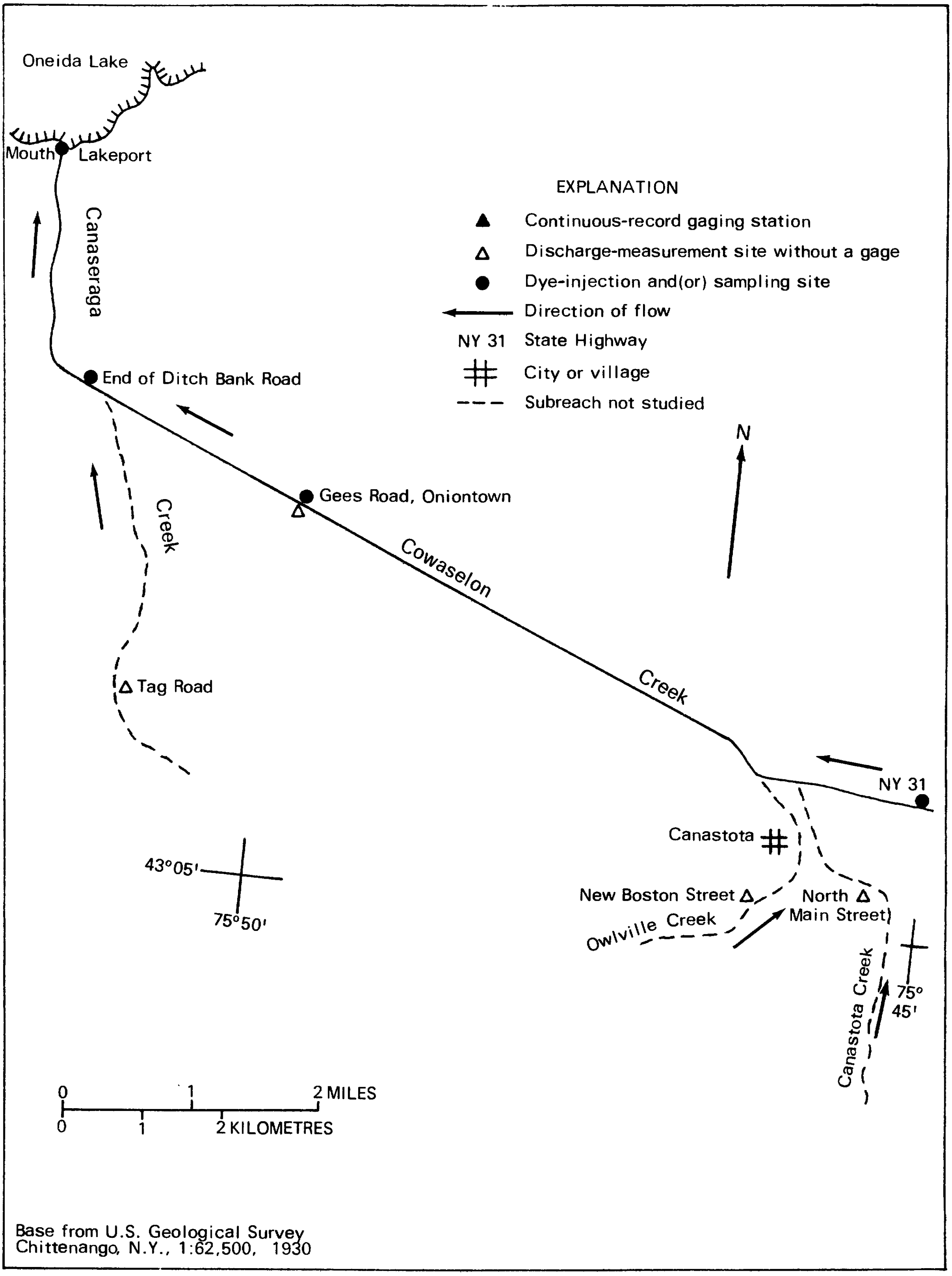


Figure 102.--Location of reach, subreaches, and measurement sites in Canaseraga Creek basin.

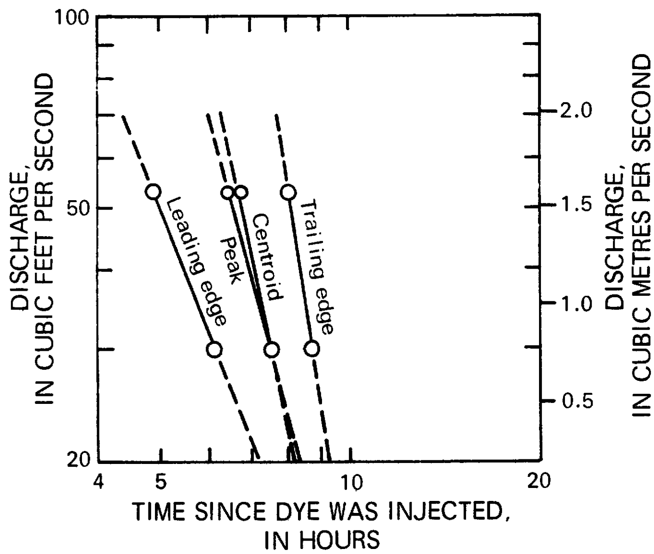


Figure 103.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Cowaselon Creek: State Highway 13 at Canastota to Gees Road at Oniontown.

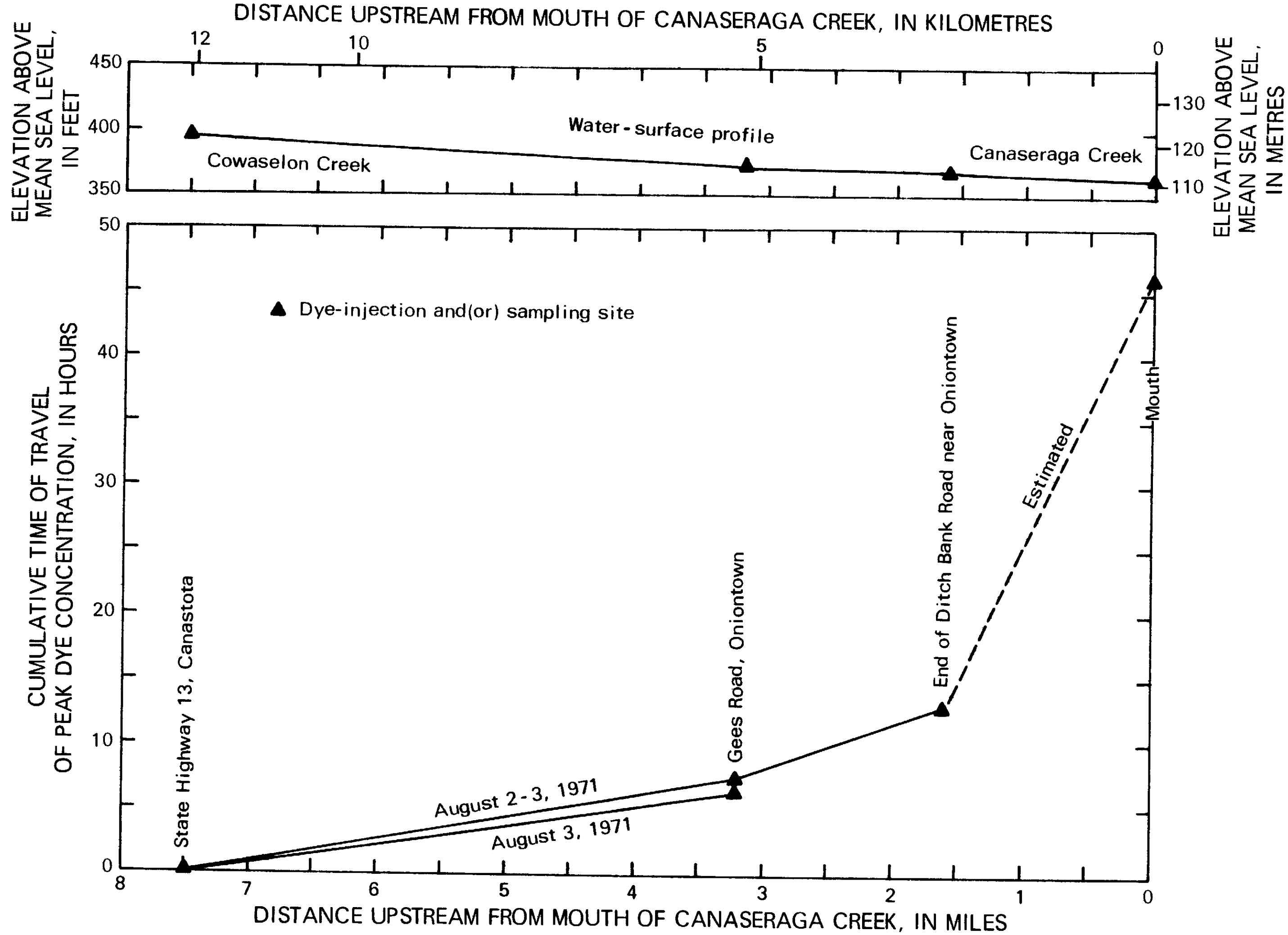


Figure 104.--Water-surface profile and cumulative time of travel of peak dye concentration from State Highway 13 at Canastota on Cowaselon Creek to mouth of Canaseraga Creek at Lakeport.

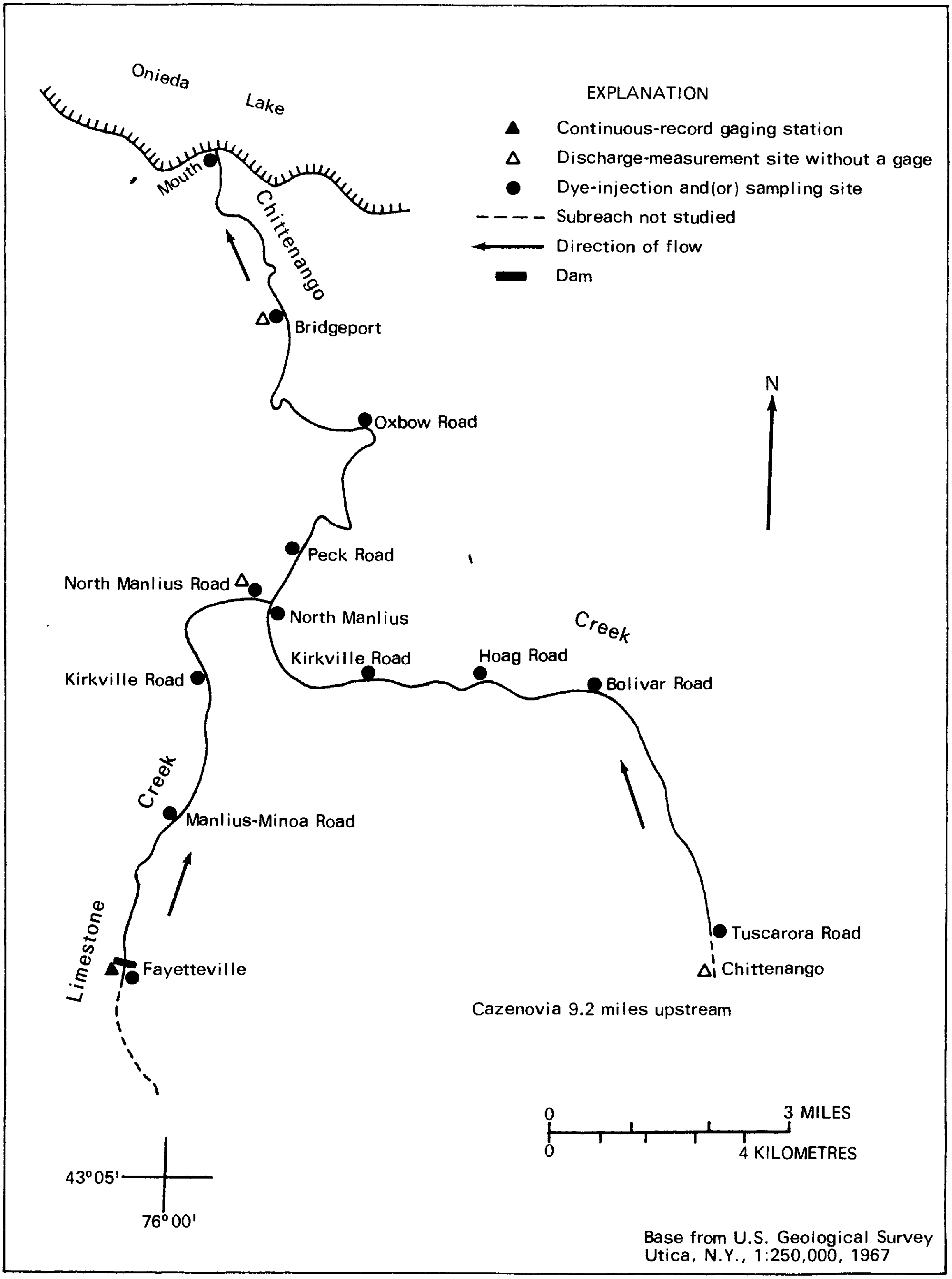


Figure 105.--Location of reach, subreaches, gaging station, and measurement sites in Chittenango Creek basin.

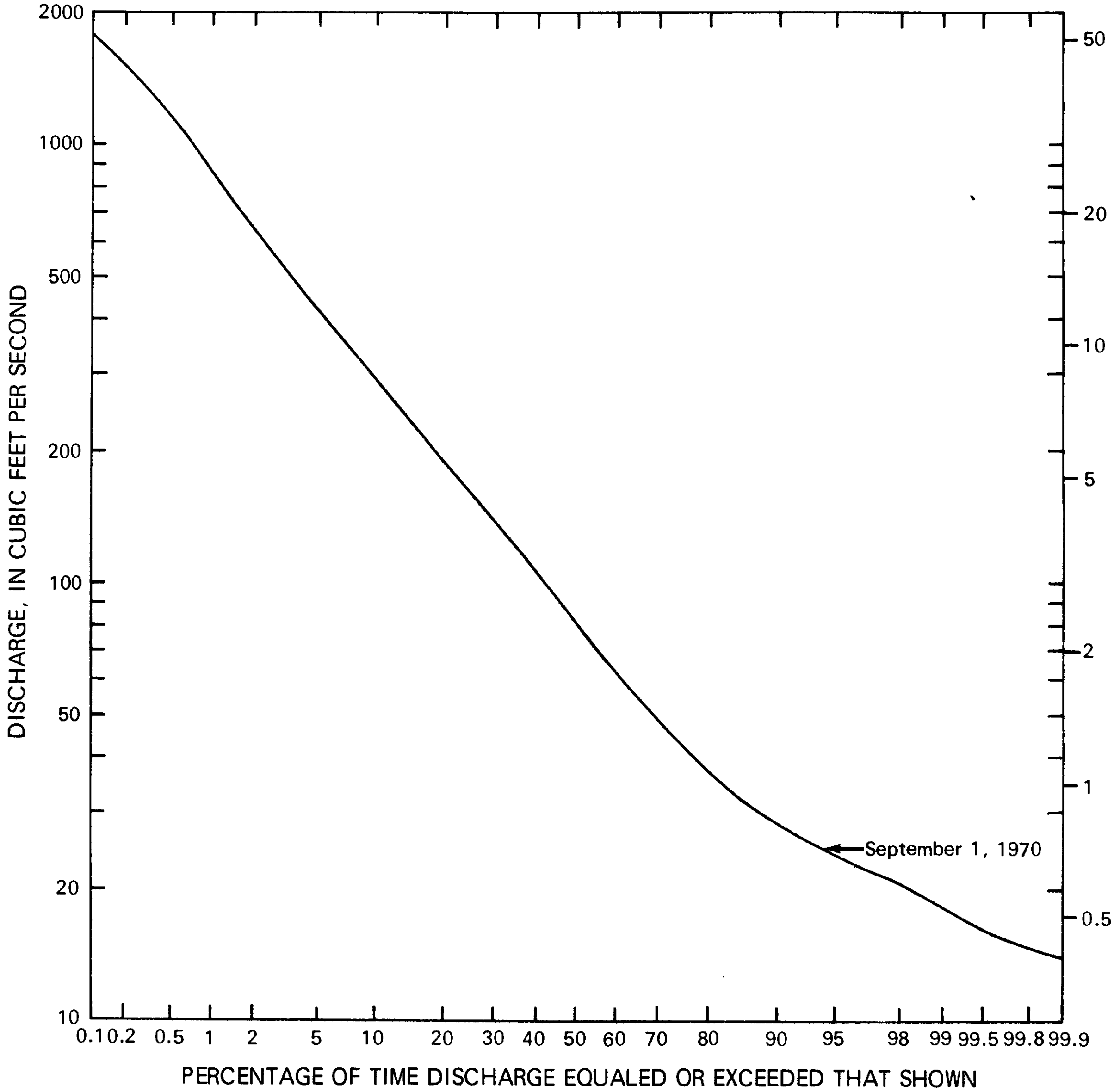


Figure 106.--Duration curve of daily mean flows for Limestone Creek at Fayetteville.

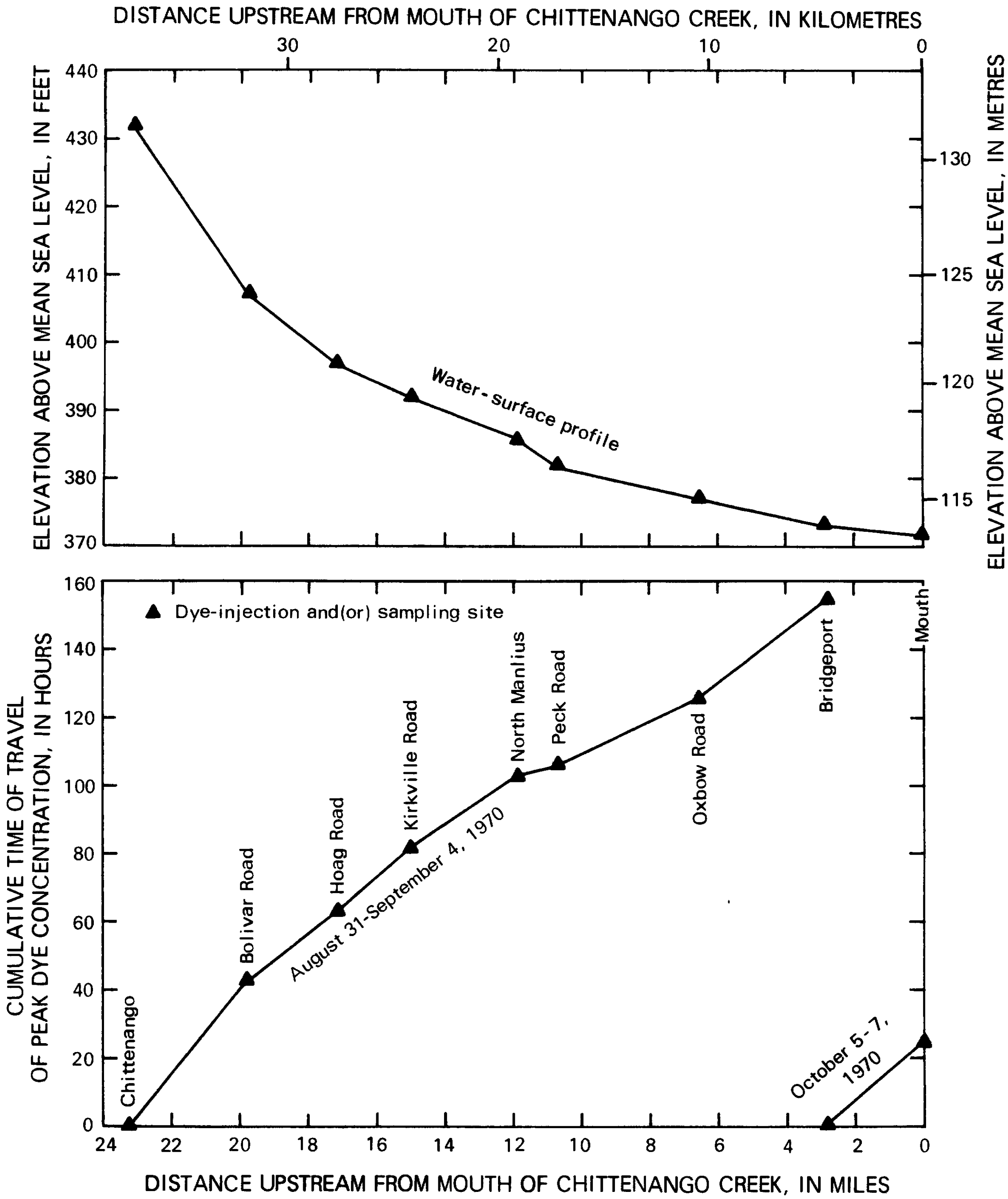


Figure 107.--Water-surface profile and cumulative time of travel of peak dye concentration for Chittenango Creek: Chittenango to mouth.

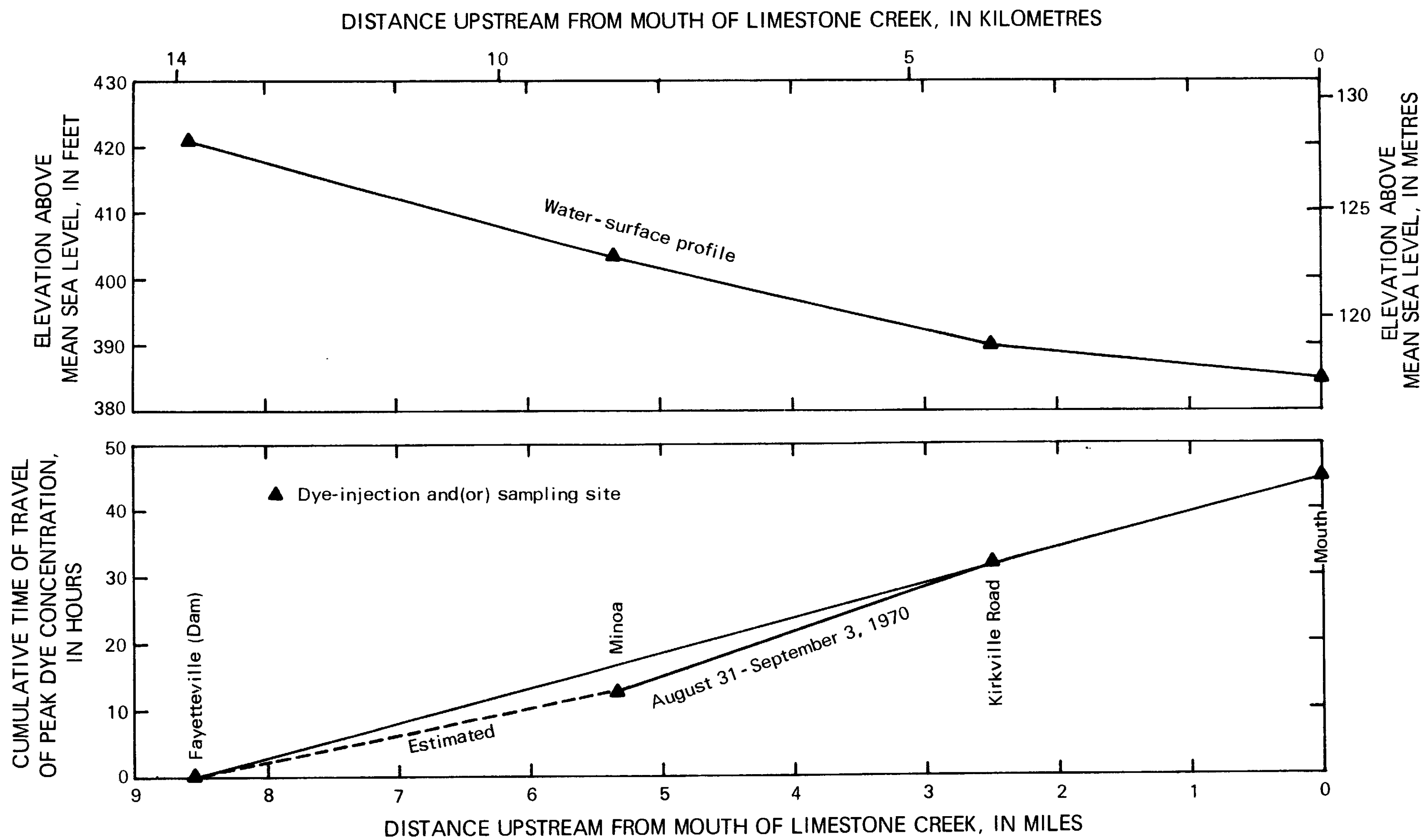


Figure 108.--Water-surface profile and cumulative time of travel of peak dye concentration for Limestone Creek: Fayetteville (dam) to mouth (North Manlius Road).

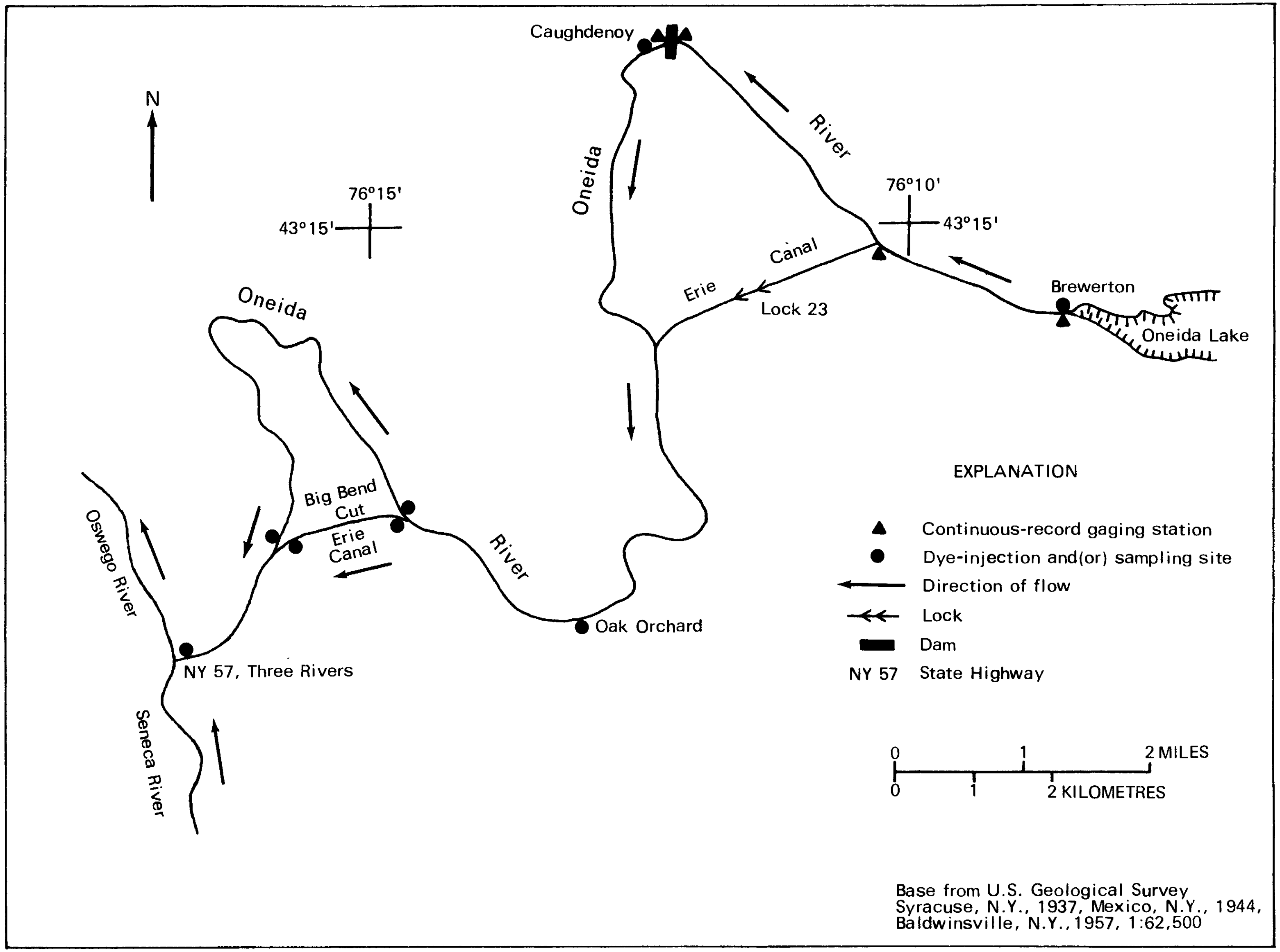


Figure 109.--Location of reach, subreaches, and gaging station for Oneida River and Erie Canal.

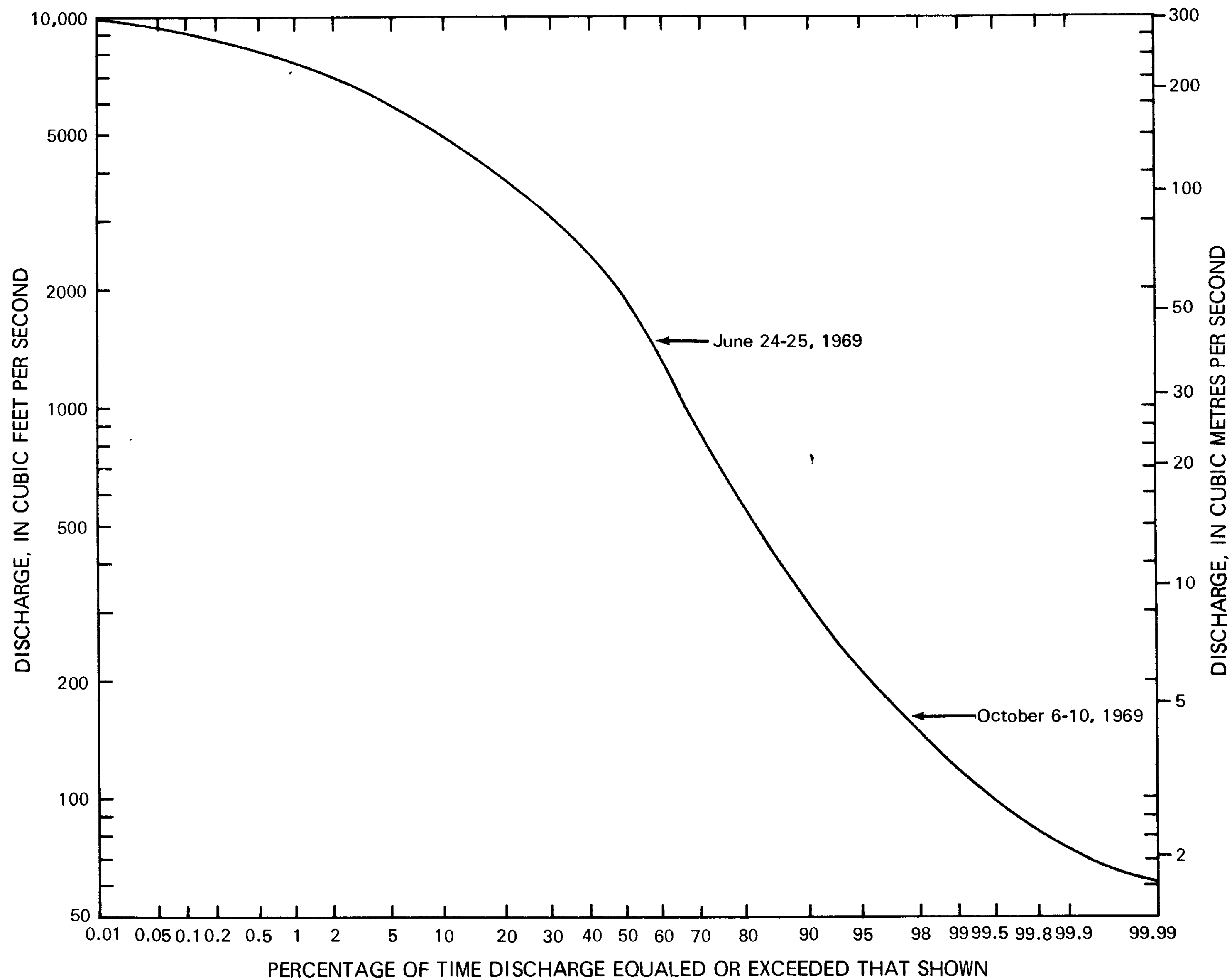


Figure 110.--Duration curve of daily mean flows for Oneida River at Caughdenoy.

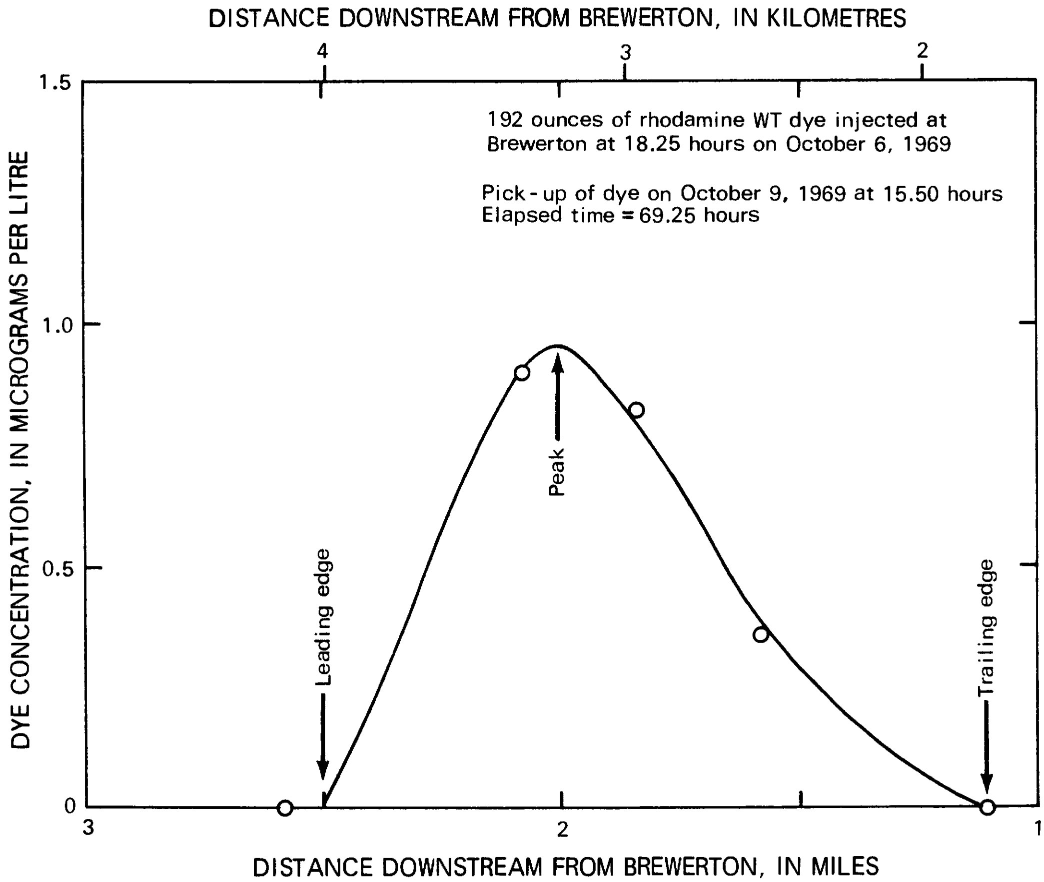


Figure 111.--Relation of dye concentration to distance traveled for Oneida River below Brewerton, October 6-9, 1969.

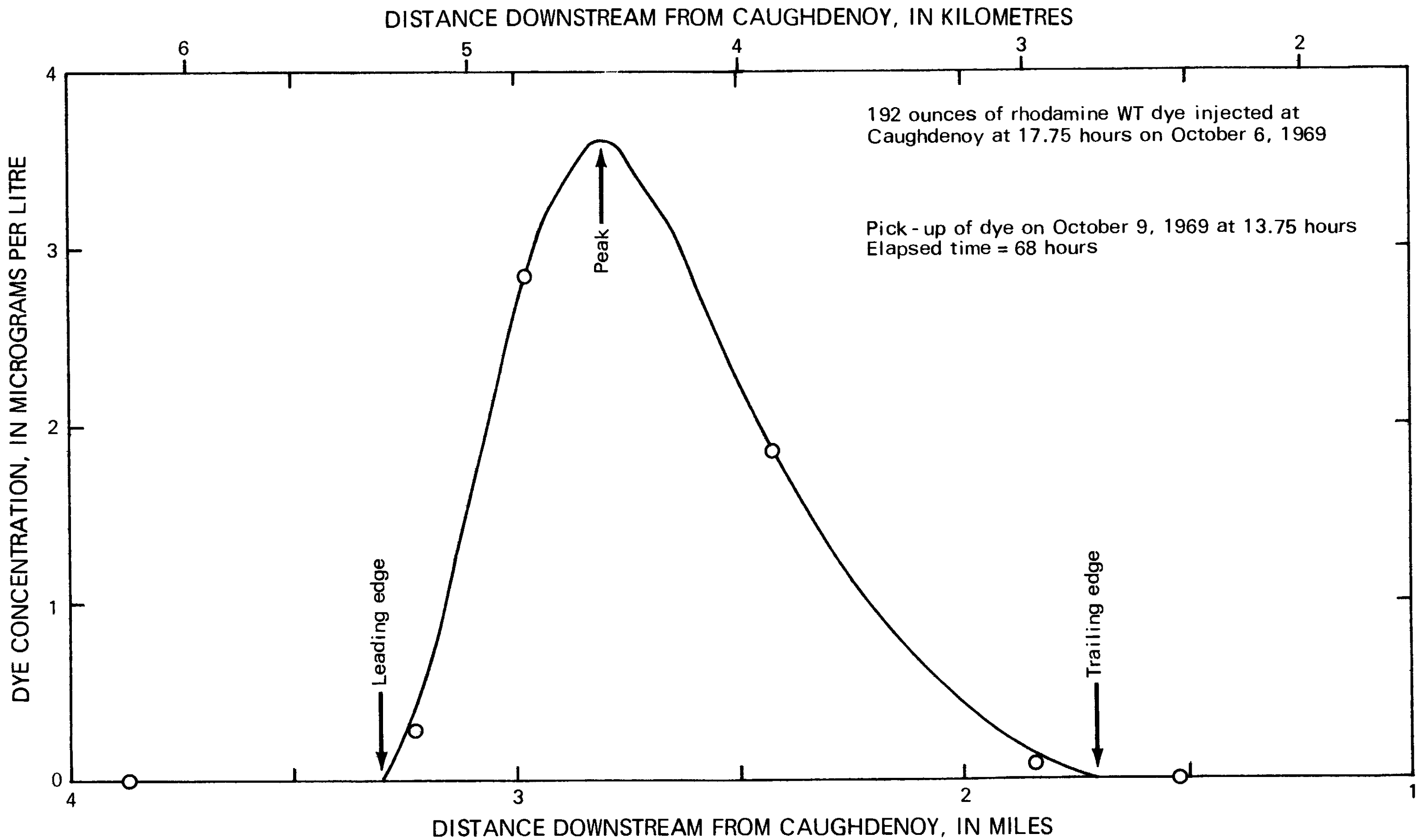


Figure 112.--Relation of dye concentration to distance traveled for Oneida River below Caughdenoy, October 6-9, 1969.

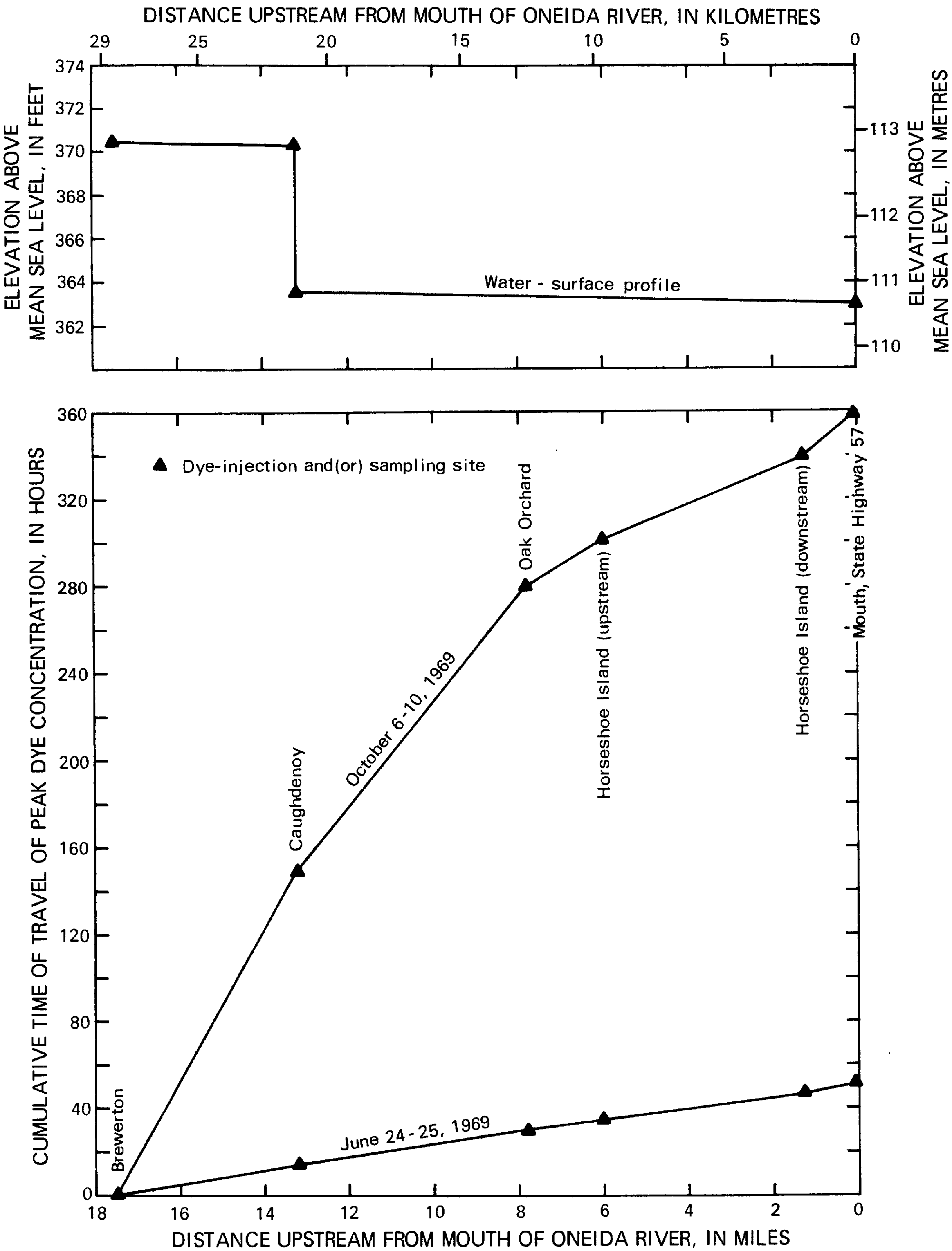


Figure 113.--Water-surface profile and cumulative time of travel of peak dye concentration for Oneida River: Brewerton to State Highway 57 at Three Rivers.

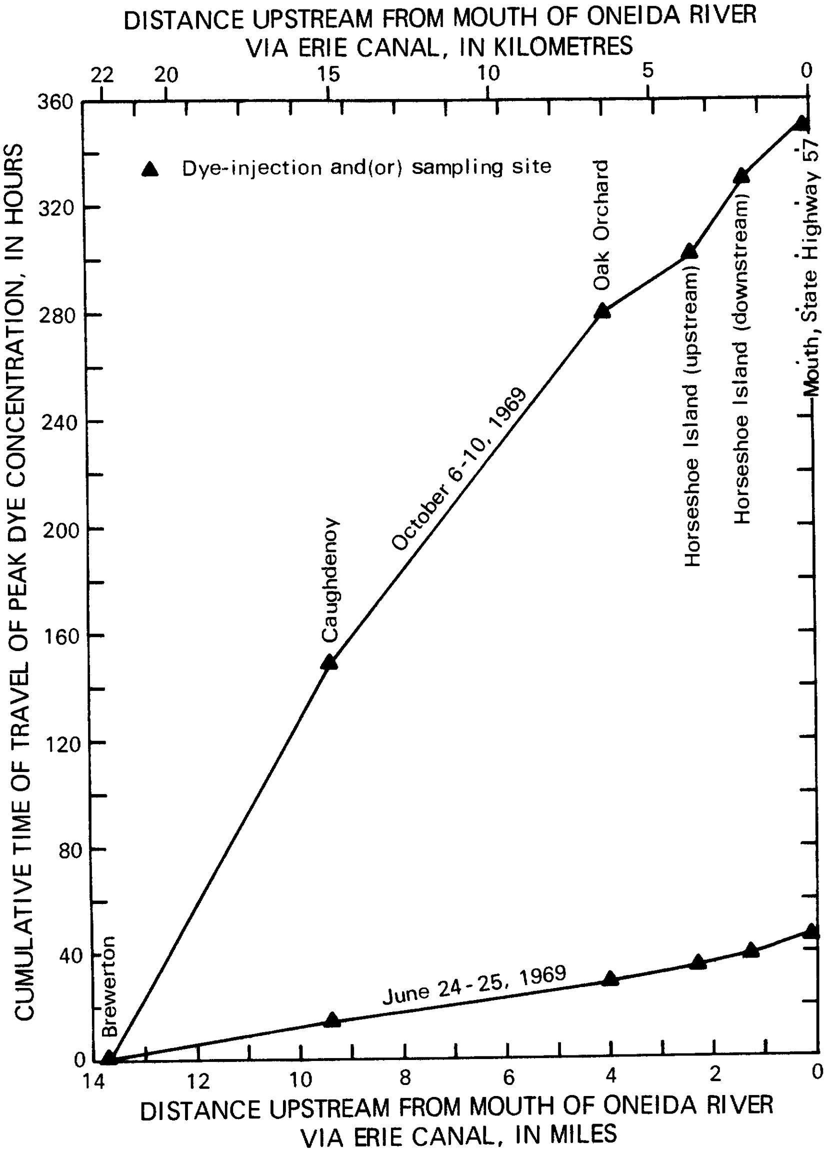


Figure 114.--Cumulative time of travel of peak dye concentration for Erie Canal via Big Bend Cut.

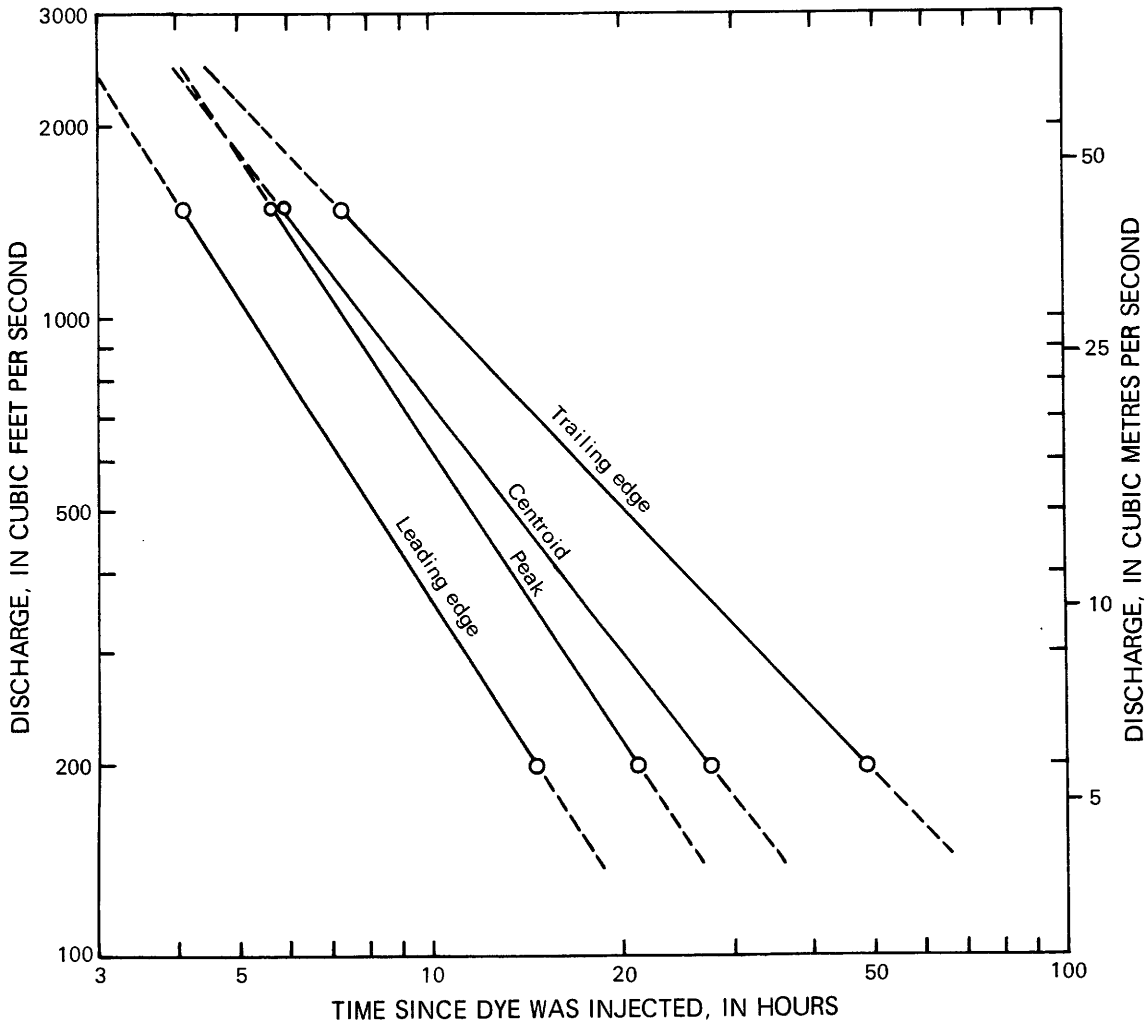


Figure 115.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Oneida River and Erie Canal: Oak Orchard to Horseshoe Island (upstream).

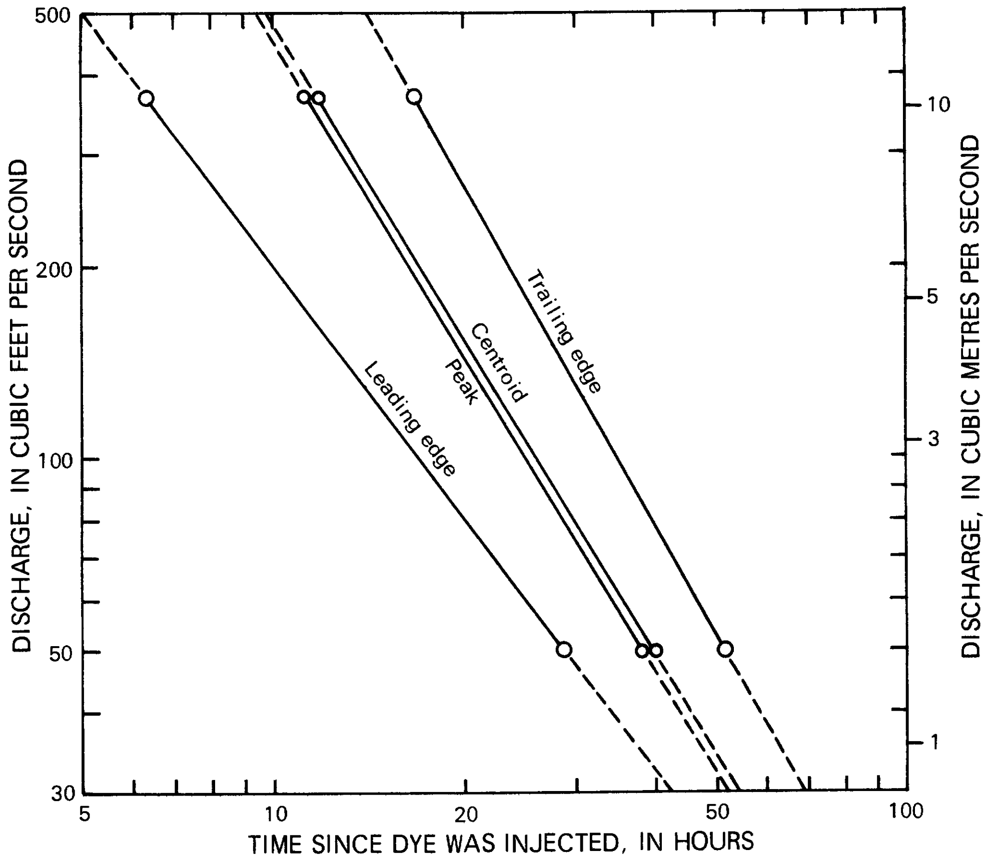


Figure 116.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Oneida River: Horseshoe Island (upstream) to Horseshoe Island (downstream).

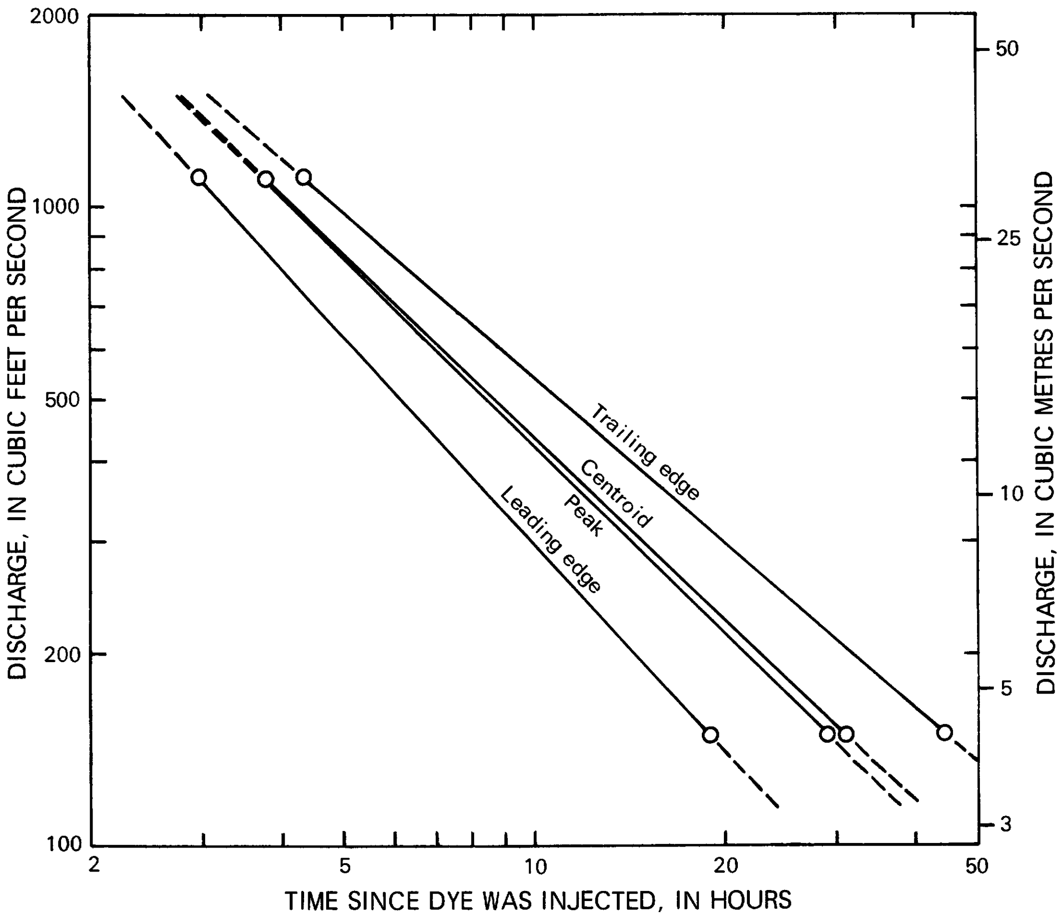


Figure 117.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Erie Canal: Horseshoe Island (upstream) to Horseshoe Island (downstream).

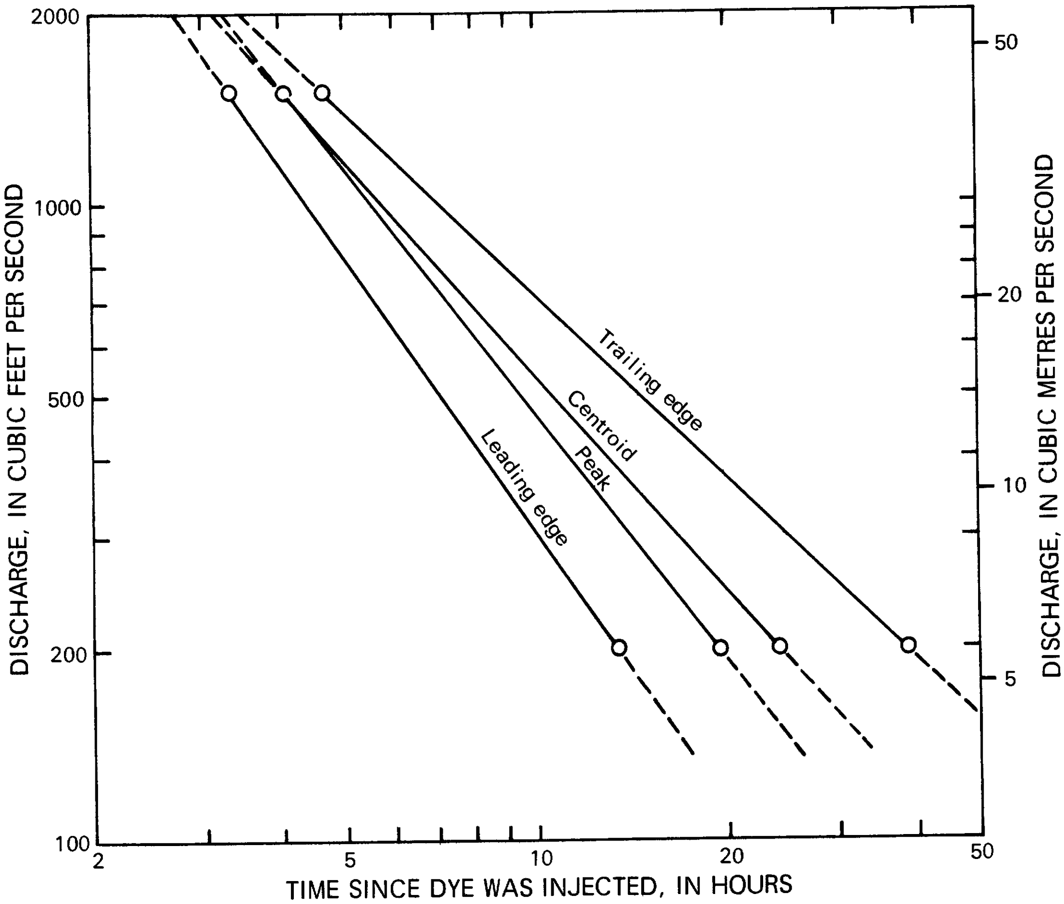


Figure 118.--Relation of discharge to time of travel of leading edge, peak, centroid, and trailing edge for Oneida River and Erie Canal: Horseshoe Island (downstream) to State Highway 57 at Three Rivers.

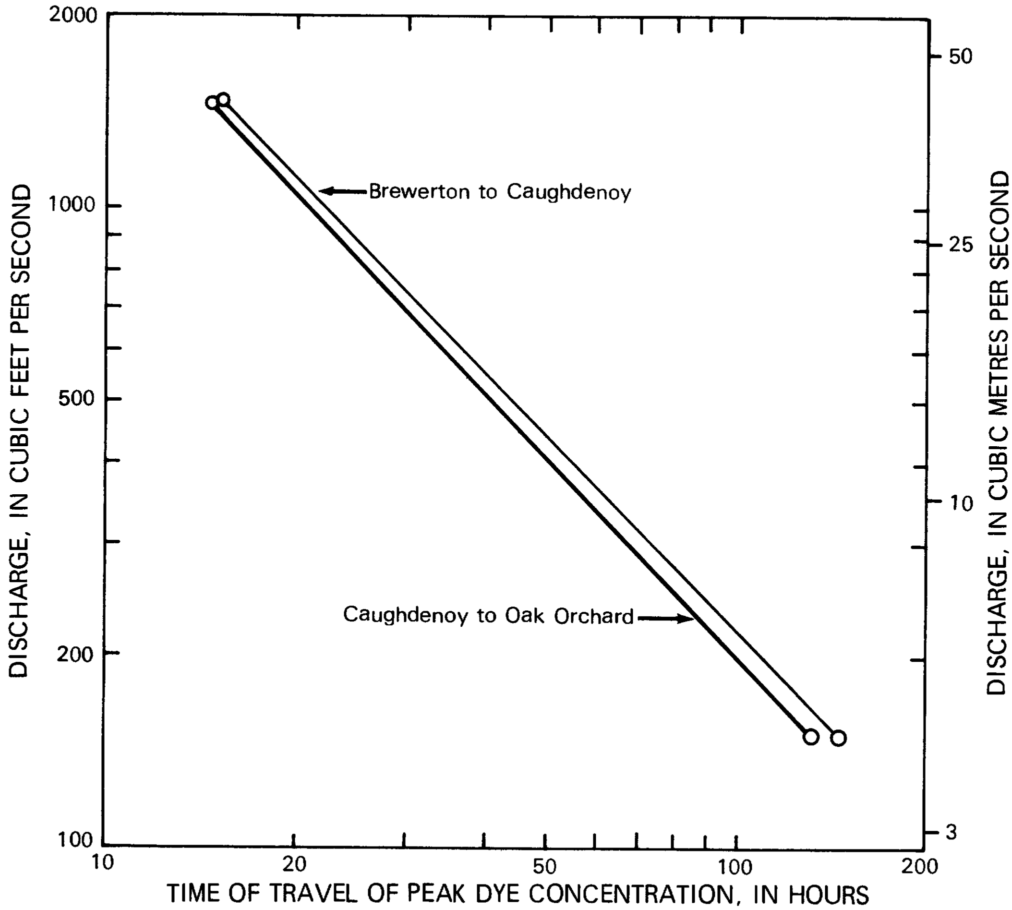


Figure 119.--Relation of discharge to time of travel of peak dye concentration for Oneida River: Brewerton to Caughdenoy and Caughdenoy to Oak Orchard.

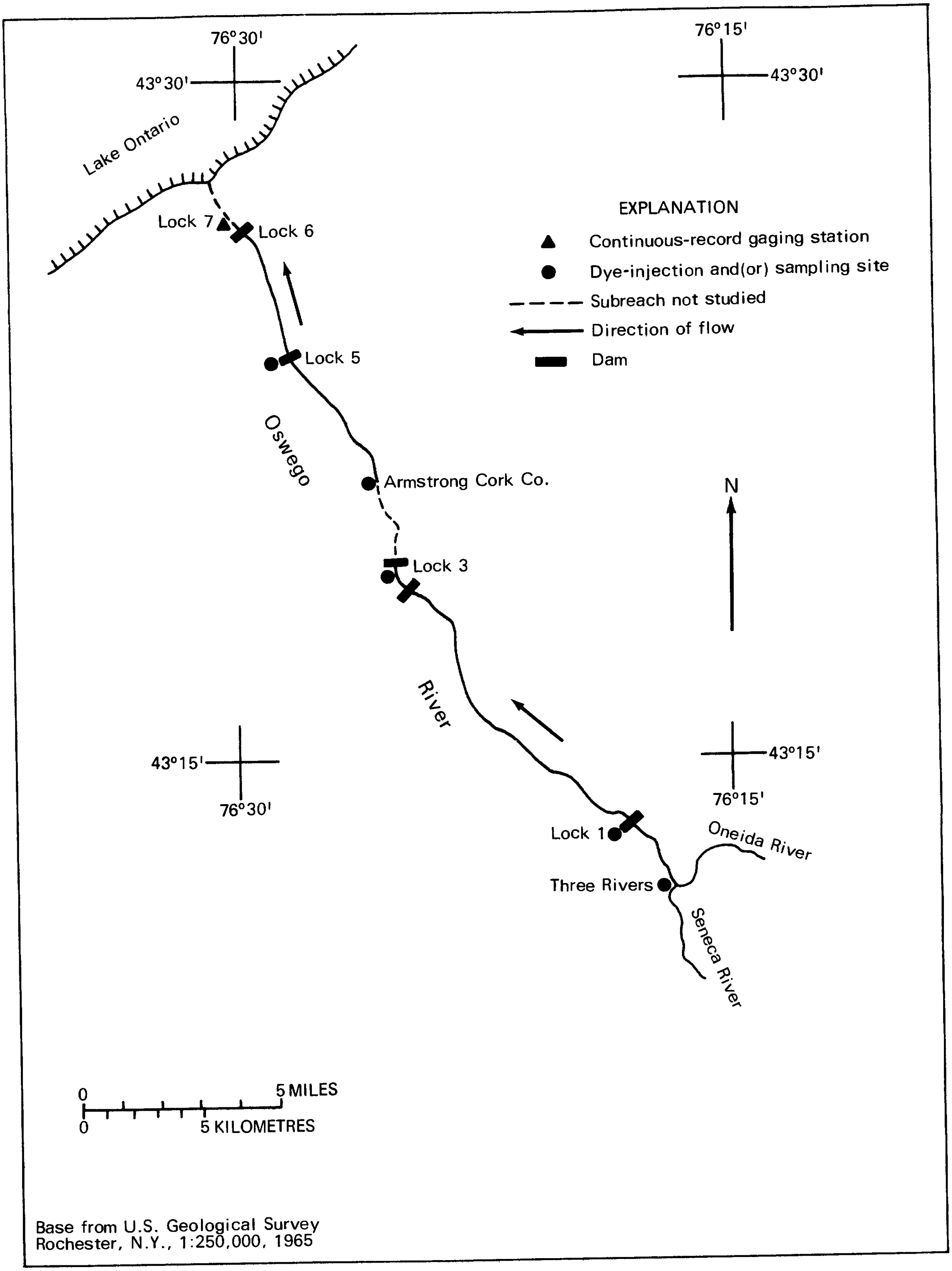


Figure 120.--Location of study reach, subreaches, and gaging station on Oswego River.

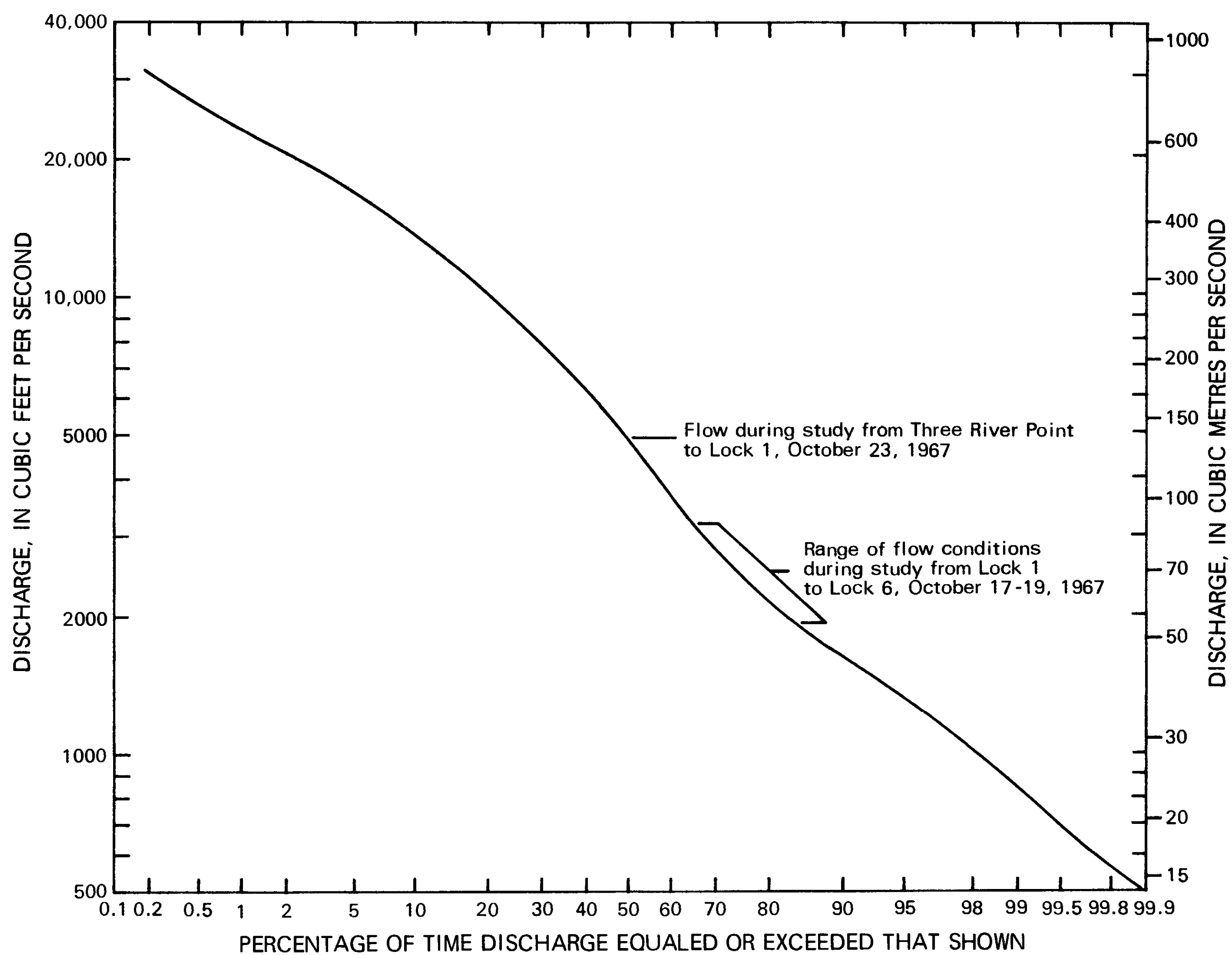


Figure 121.--Duration curve of daily mean flows for Oswego River at Lock 7 at Oswego (1935-72).

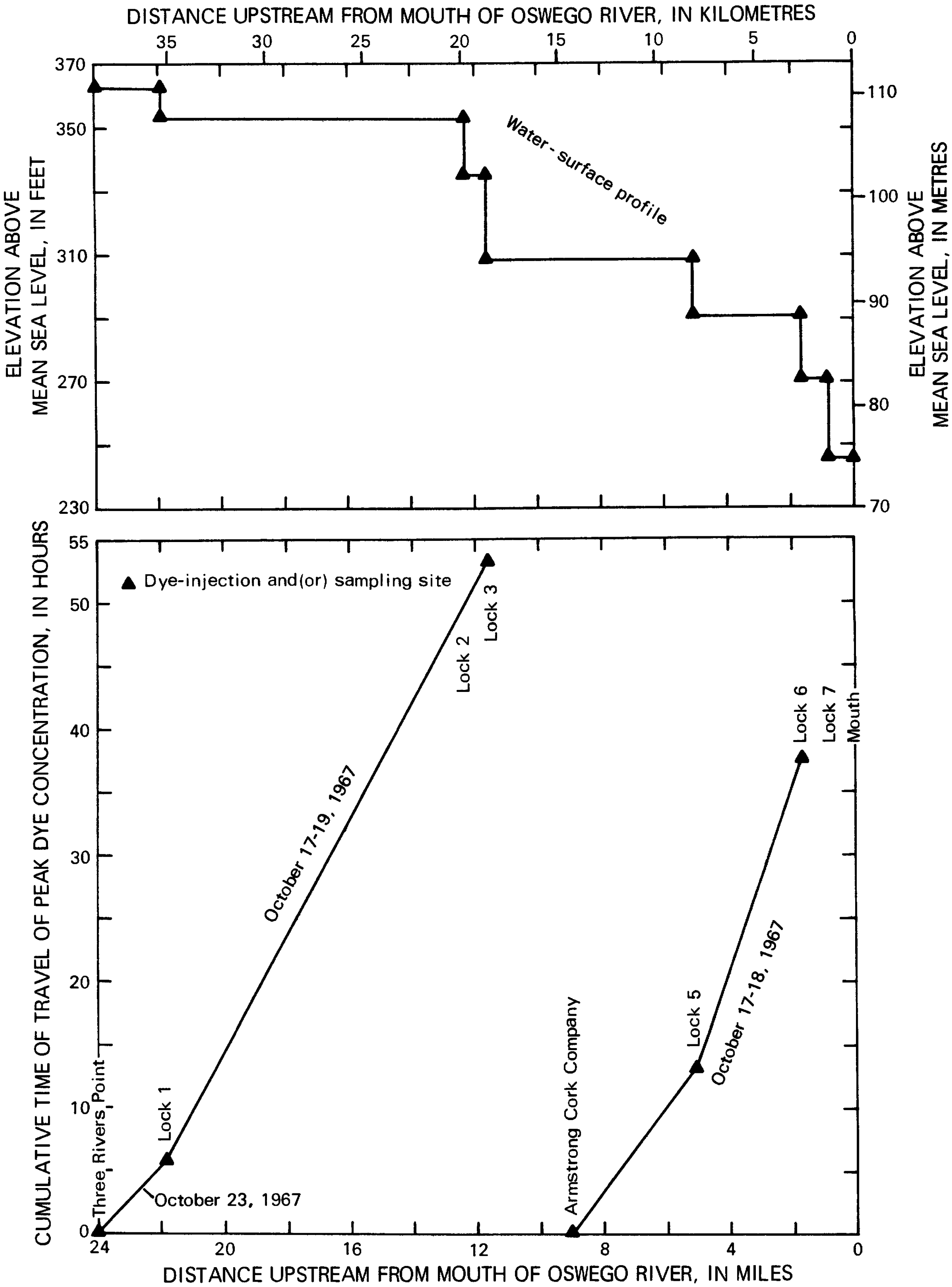


Figure 122.--Water-surface profile and cumulative time of travel of peak dye concentration for Oswego River: Three Rivers to Lock 7.

TABLE 1

Data for time-of-travel studies in Oswego River basin,

in downstream order

TABLE 1.--DATA FOR TIME-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO	DAY	YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)	
CATHARINE CR AT MILLPORT	42 15 56	76 50 08	9	22	70	6.75	9.5	1	9.0	2	WT
CATHARINE CR AT CROTON ROAD	42 17 46	76 50 49	9	22	70	6.65	7.2	1	10	2	WT
CATHARINE CR AT SOUTH GENESEE ROAD	42 19 42	76 50 40	9	22	70	6.50	4.5	1	11	2	WT
CATHARINE CR AT SH 224	42 20 57	76 50 23	9	21	70	15.50	2.9	1	13	16	WT
KEUKA INLET TRIB 3 TAYLOR WINE TP	42 23 42	77 15 30	7	10	74	10.05	1/2.1	1	0.3	1	WT
KEUKA INLET TRIB 3 DEAD END ROAD	42 24 07	77 14 41	7	10	74	9.93	1/1.6	1	0.3	1	WT
KEUKA INLET TRIB 3 AT RR NR MOUTH	42 24 13	77 13 53	7	10	74	10.20	1/0.8	1	0.4	2	WT
KEUKA LAKE O AT PENN YAN AT RR	42 39 38	77 02 53	8	26	69	8.75	6.6	1	65	2	WT
KEUKA LAKE O AT PENN YAN AT RR	42 39 38	77 02 53	8	27	69	8.33	6.6	2	14	2	WT
KEUKA LAKE O AT PENN YAN AT RR	42 39 38	77 02 53	8	28	69	7.92	6.6	3	50	2	WT
KEUKA LAKE O AT KEUKA MILLS	42 39 35	77 02 15	8	26	69	8.42	6.0	1	65	4	WT
KEUKA LAKE O AT KEUKA MILLS	42 39 35	77 02 15	8	27	69	8.17	6.0	2	14	4	WT
KEUKA LAKE O AT KEUKA MILLS	42 39 35	77 02 15	8	28	69	6.83	6.0	3	50	4	WT
KEUKA LAKE O AT MAYS MILLS	42 40 01	76 59 42	8	26	69	8.17	3.2	1	65	4	WT
KEUKA LAKE O AT MAYS MILLS	42 40 01	76 59 42	8	27	69	7.92	3.2	2	14	4	WT
KEUKA LAKE O AT MAYS MILLS	42 40 01	76 59 42	8	28	69	6.67	3.2	3	50	4	WT
FALL CR AT SH 366 MOUTH VIRGIL CR	42 30 19	76 21 36	10	9	74	7.07	12.0	4	50	4	WT
FALL CR AT DAM OF BEEBE LAKE	42 27 06	76 28 48	10	8	74	15.75	1.8	4	75	10	WT
FISH CR AT SITE NO. 562	42 54 15	77 25 15	12	5	73	8.28	7.4	1	2.4	1	WT
FISH CR AT SITE NO. 565	42 54 41	77 25 03	12	5	73	8.17	6.7	1	2.5	1	WT
FISH CR AT SITE NO. 566	42 54 58	77 24 26	12	5	73	7.98	6.0	1	2.5	1	WT
FISH CR AT SITE NO. 567	42 55 13	77 23 56	12	5	73	7.87	5.5	1	2.5	1	WT
FISH CR AT SITE NO. 568	42 55 42	77 23 40	12	5	73	7.68	4.7	1	2.8	2	WT
FISH CR AT SITE NO. 567	42 55 13	77 23 56	12	5.	73	7.87	5.5	1	2.5	1	WT
FISH CR AT SITE NO. 571	42 56 38	77 23 23	12	5	73	7.50	3.4	1	3.1	1	WT
FISH CR AT SITE NO. 568	42 55 42	77 23 40	12	5	73	7.68	4.7	1	2.8	2	WT
FISH CR AT SITE NO. 572	42 57 39	77 22 55	12	5	73	7.33	1.5	1	3.0	1	WT
MUD CREEK AT SH 96 AT E VICTOR	42 58 28	77 22 57	7	20	71	19.92	2/32.7	1	5.0	4	WT
GANARGUA CR AT GILLIS RD	43 00 43	77 22 06	7	20	71	7.83	29.4	1	24	6	WT
GANARGUA CR AT WILSON RD	43 02 38	77 20 28	7	20	71	7.58	26.2	1	29	6	WT

B. SAMPLING SITES

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
CATHARINE CR AT CROTON ROAD	7.2	2.3	10	3.50	0.96	4.25	0.79	4.51	0.75	5.80
CATHARINE CR AT S GENESEE ROAD	4.5	2.7	11	4.35	0.91	5.35	0.74	5.45	0.73	6.83
CATHARINE CR AT SH 224	2.9	1.6	13	2.00	1.17	2.50	0.94	2.66	0.88	3.50
CATHARINE CR AT SH 414	0.0	2.9	16	20.50	0.21	36.00	0.12	34.75	0.12	47.50
KEUKA INLET TRIB 3 DEAD END RD	1/1.6	0.5	0.3	0.65	1.13	0.92	0.80	1.02	0.72	1.55
KEUKA INLET 54A HAMMONDSPORT	0.3	1.3	6.0	13.87	0.14	17.27	0.11	17.60	0.11	21.57
KEUKA INLET 54A HAMMONDSPORT	0.3	0.5	5.3	3.80	0.19	5.40	0.14	5.88	0.12	8.40
KEUKA LAKE O AT KEUKA MILLS	6.0	0.6	65	0.68	1.29	0.83	1.06	0.90	0.97	1.22
KEUKA LAKE O AT KEUKA MILLS	6.0	0.6	14	1.67	0.53	2.09	0.42	2.29	0.38	3.17
KEUKA LAKE O AT KEUKA MILLS	6.0	0.6	50	0.75	1.17	1.08	0.81	1.11	0.79	1.53
KEUKA LAKE O AT MAYS MILLS	3.2	2.8	65	2.17	1.89	2.58	1.59	2.67	1.54	3.28
KEUKA LAKE O AT MAYS MILLS	3.2	2.8	14	5.18	0.79	6.10	0.67	6.34	0.65	7.83
KEUKA LAKE O AT MAYS MILLS	3.2	2.8	50	2.49	1.65	3.02	1.36	3.08	1.33	3.82
KEUKA LAKE O AT GAGE DRESDEN	0.4	2.8	65	2.16	1.90	2.59	1.59	2.69	1.52	3.29
KEUKA LAKE O AT GAGE DRESDEN	0.4	2.8	14	5.18	0.79	6.16	0.67	6.31	0.65	7.62
KEUKA LAKE O AT GAGE DRESDEN	0.4	2.8	50	2.50	1.64	2.93	1.40	3.05	1.34	3.72
FALL CR AT ETNA	9.9	2.1	55	3.53	0.87	4.33	0.71	4.68	0.66	6.15
FALL CR AT STEWART PARK FT BR	0.3	1.5	80	4.85	0.45	6.45	0.34	7.54	0.29	10.85
FISH CR AT SITE NO. 565	6.7	0.7	2.5	1.57	0.65	1.97	0.52	2.08	0.49	2.69
FISH CR AT SITE NO. 566	6.0	0.7	2.5	1.98	0.52	2.43	0.42	2.50	0.41	3.16
FISH CR AT SITE NO. 567	5.5	0.5	2.5	1.82	0.40	2.27	0.32	2.45	0.30	3.27
FISH CR AT SITE NO. 568	4.7	0.8	2.8	2.53	0.46	3.10	0.38	3.16	0.37	3.86
FISH CR AT SITE NO. 571	3.4	1.3	3.1	7.32	0.26	8.02	0.24	8.17	0.23	9.52
FISH CR AT SITE NO. 571	3.4	2.1	3.1	9.83	0.31	11.08	0.28	11.48	0.27	13.78
FISH CR AT SITE NO. 572	1.5	1.9	3.0	7.60	0.37	8.70	0.32	9.38	0.30	11.90
FISH CR AT SITE NO. 572	1.5	3.2	3.0	15.42	0.30	17.82	0.26	18.56	0.25	22.52
FISH CR AT SITE NO. 574	0.2	1.3	3.0	3.82	0.50	5.12	0.37	5.25	0.36	6.72
GANARGUA CR AT GILLIS RD	29.4	3.3	24	13.48	0.36	16.58	0.29	17.31	0.28	21.88
GANARGUA CR AT WILSON RD	26.2	3.2	29	7.47	0.63	9.67	0.49	10.43	0.45	14.07
GANARGUA CR AT MACEDON	22.9	3.3	48	7.12	0.68	10.07	0.48	10.26	0.47	13.88

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

TABLE 1.--DATA FOR TIME-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER--CONTINUED

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO DAY YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)
GANARGUA CR AT MACEDON	43 04 04	77 17 54	7 20 71	7.33	22.9	1	48	6 WT
GANARGUA CR AT MACEDON	43 04 04	77 17 54	7 20 71	7.33	22.9	1	48	6 WT
GANARGUA CR AT WILSON RD	43 02 38	77 20 28	7 20 71	7.58	26.2	1	29	6 WT
GANARGUA CR AT MACEDON	43 04 04	77 17 54	8 5 71	6.90	22.9	1	11	5 WT
GANARGUA CR AT HOGBACK RD	43 04 15	77 11 06	1 15 75	7.43	16.2	1	60	20 WT
GANARGUA CR AT HOGBACK RD	43 04 15	77 11 06	11 16 67	8.75	16.2	1	475	48 B
GANARGUA CR AT TOWN LINE	43 05 14	77 08 13	11 16 67	9.00	12.4	1	500	48 B
GANARGUA CR AT TOWN LINE	43 05 14	77 08 13	1 15 75	7.17	12.4	2	80	20 WT
GANARGUA CR AT TOWN LINE	43 05 14	77 08 13	1 15 75	7.17	12.4	1	80	20 WT
GANARGUA CR AT SH 88	43 04 04	77 05 34	11 15 67	9.33	8.4	1	564	32 B
GANARGUA CR AT SH 88	43 04 04	77 05 34	1 15 75	6.83	8.4	2	125	20 WT
GANARGUA CR AT NORSEN RD	43 05 53	77 03 41	11 15 67	9.00	5.2	1	564	40 B
GANARGUA CR AT LYONS NEWARK RD	43 03 50	77 00 12	11 14 67	13.17	3/20.3	1	564	16 B
NAPLES CR SH 245 AT NAPLES	42 37 34	77 23 25	9 15 70	7.25	4/ 3.9	1	65	8 WT
NAPLES CR SH 245 AT NAPLES	42 37 34	77 23 25	9 17 70	12.10	4/ 3.9	2	12	16 WT
NAPLES CR AT PARISH FLAT RD	42 38 43	77 22 26	9 14 70	16.40	4/ 2.2	1	65	32 WT
CANANDAIGUA OUTLET AT SH 5&20	42 52 32	77 16 18	11 29 67	1.00	33.2	1	53	16 B
CANANDAIGUA OUTLET AT SH 5&20	42 52 32	77 16 18	9 15 70	14.00	33.2	2	25	36 WT
CANANDAIGUA OUTLET AT SHORTSVILLE	42 57 21	77 13 11	11 29 67	1.25	25.5	1	60	16 B
CANANDAIGUA OUTLET AT SHORTSVILLE	42 57 21	77 13 11	9 15 70	13.00	25.5	2	27	32 WT
CANANDAIGUA OUTLET CLIFTON SPRINGS	42 58 31	77 08 30	11 28 67	9.25	18.7	1	92	16 B
CANANDAIGUA OUTLET CLIFTON SPRINGS	42 58 31	77 08 30	9 14 70	19.50	18.7	2	32	32 WT
CANANDAIGUA OUTLET AT FLINT CR	42 57 38	77 02 56	11 28 67	9.00	12.8	1	140	16 B
CANANDAIGUA OUTLET AT FLINT CR	42 57 38	77 02 56	9 14 70	22.75	12.8	2	32	32 WT
CANANDAIGUA OUTLET AT GIFFORD RD	42 59 00	76 58 54	11 28 67	7.25	6.7	1	300	32 B
CANANDAIGUA OUTLET AT GIFFORD RD	42 59 00	76 58 54	9 14 70	15.50	6.7	2	56	64 WT
CLYDE R ERIE CANAL AT LOCK 27	43 03 44	76 59 49	11 14 67	10.00	20.0	1	900	48 B
CLYDE R ERIE CANAL AT CRAEGER BR	43 01 55	76 57 14	11 14 67	9.50	17.0	1	900	80 B
CLYDE R ERIE CANAL AT SH 414	43 04 53	76 52 18	11 14 67	9.00	10.6	1	900	32 B
CLYDE R ERIE CANAL AT LOCK 26	43 03 34	76 50 19	11 13 67	15.50	8.3	1	850	80 B

B. SAMPLING SITES

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
GANARGUA CR SH 31 YW MILLS 5A	19.9	3.0	51	2.17	2.03	6.77	0.65	6.01	0.73	8.83
GANARGUA CR SH 31 YW MILLS 5B	19.9	3.0	51	2.17	2.03	5.17	0.85	4.81	0.92	6.89
GANARGUA CR SH 31 YW MILLS	19.9	6.3	51	19.42	0.48	24.92	0.37	24.44	0.38	28.22
GANARGUA CR AT YELLOW MILLS RD	20.3	2.6	12	15.10	0.25	20.30	0.19	20.75	0.18	26.80
GANARGUA CR AT SH 88	8.4	7.8	125	20.77	0.55	23.77	0.48	24.25	0.47	27.97
GANARGUA CR AT TOWN LINE	12.4	3.8	564	4.95	1.13	5.50	1.01	5.79	0.96	6.95
GANARGUA CR AT SH 88	8.4	4.0	564	4.80	1.22	5.80	1.01	6.18	0.95	7.65
GANARGUA CR AT SH 88	8.4	4.0	125	8.63	0.68	10.03	0.59	10.47	0.56	12.83
GANARGUA CR AT NORSEN RD	5.2	7.2	153	15.63	0.68	17.43	0.61	17.83	0.59	20.58
GANARGUA CR AT NORSEN RD	5.2	3.2	564	3.17	1.48	4.42	1.06	4.58	1.02	5.87
GANARGUA CR AT NORSEN RD	5.2	3.2	153	7.77	0.60	8.77	0.54	9.13	0.51	10.97
GANARGUA CR AT LYONS NEWARK RD	0.1	5.1	564	6.50	1.15	8.00	0.94	8.23	0.91	10.20
ERIE CANAL AT LOCK 27	3/20.0	0.3	564	1.48	0.30	1.63	0.27	1.84	0.24	2.48
NAPLES CR AT PARISH FLAT RD	4/ 2.2	1.7	65	1.00	2.49	1.40	1.78	1.42	1.76	1.83
NAPLES CR AT PARISH FLAT RD	4/ 2.2	1.7	12	3.20	0.78	4.00	0.62	4.15	0.60	5.30
WEST RIVER NR MOUTH	0.2	2.0	50	15.60	0.19	24.60	0.12	36.56	0.08	66.10
CANANDAIGUA OUTLET SHORTSVILLE	25.5	7.7	60	15.50	0.73	19.30	0.59	20.31	0.56	26.00
CANANDAIGUA OUTLET SHORTSVILLE	25.5	7.7	27	31.50	0.36	37.75	0.30	40.58	0.28	52.90
CANANDAIGUA O CLIFTON SPRINGS	18.7	6.8	92	10.50	0.95	12.00	0.83	12.51	0.80	14.95
CANANDAIGUA O CLIFTON SPRINGS	18.7	6.8	32	20.00	0.50	22.50	0.44	22.94	0.43	26.00
CANANDAIGUA OUTLET AT FLINT CR	12.8	5.9	140	6.25	1.38	7.50	1.15	8.32	1.04	10.55
CANANDAIGUA OUTLET AT FLINT CR	12.8	5.9	32	15.80	0.55	18.50	0.47	19.31	0.45	23.70
CANANDAIGUA OUTLET GIFFORD RD	6.7	6.1	300	5.25	1.70	6.65	1.35	6.99	1.28	9.05
CANANDAIGUA OUTLET GIFFORD RD	6.7	6.1	56	18.55	0.48	22.25	0.40	22.77	0.39	27.55
CANANDAIUGA OUTLET AT LYONS	0.1	6.6	310	10.25	0.94	13.75	0.70	14.33	0.68	18.55
CANANDAIGUA OUTLET AT LYONS	0.1	6.6	58	40.00	0.24	50.00	0.19	52.62	0.18	67.50
CLYDE R ERIE C AT CREAGER BR	17.0	3.0	900	8.00	0.55	8.90	0.49	9.23	0.48	11.20
CLYDE R ERIE CANAL AT SH 414	10.6	6.4	900	21.30	0.44	22.90	0.41	24.72	0.38	28.20
CLYDE R ERIE CANAL AT LOCK 26	8.3	2.3	900	8.25	0.41	9.00	0.37	9.26	0.36	10.75
CLYDE R AT SH 89	1.9	6.4	850	24.50	0.38	27.75	0.34	28.15	0.33	31.25

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

TABLE 1.--DATA FOR TIME-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER--CONTINUED

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO	DAY	YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)	
CLYDE RIVER AT SH 89	42 59 58	76 43 52	11	8	67	8.75	1.9	1	800	32	B
OWASCO INLET AT SH 222 GROTON	42 35 27	76 22 08	7	15	74	16.55	15.9	1	11	3	WT
OWASCO INLET AT SH 38	42 37 05	76 23 04	7	15	74	16.08	13.4	1	12	3	WT
OWASCO INLET AT SH 38 LEHIGH V RR	42 38 32	76 24 28	7	15	74	15.95	11.0	1	16	3	WT
OWASCO INLET AT SH 90 LOCKE	42 39 34	76 25 43	7	15	74	13.10	8.9	1	21	4	WT
OWASCO INLET AT DEAD END ROAD	42 40 33	76 25 57	7	15	74	13.43	7.6	1	25	4	WT
OWASCO INLET AT SH 90 LOCKE	42 39 34	76 25 43	7	15	74	13.10	8.9	1	21	4	WT
OWASCO INLET AT LONG HILL RD	42 42 37	76 26 04	7	15	74	12.78	4.6	1	30	2	WT
OWASCO O AT CANOGA ST AT AUBURN	43 56 15	76 35 38	6	30	70	7.67	12.3	1	35	5	WT
OWASCO O AT CANOGA ST AT AUBURN	43 56 15	76 35 38	7	2	70	6.17	12.3	2	69	6	WT
OWASCO O AT THROOPSVILLE	43 58 22	76 36 01	6	30	70	7.50	9.1	1	35	4	WT
OWASCO O AT THROOPSVILLE	43 58 22	76 36 01	7	2	70	6.08	9.1	2	69	5	WT
OWASCO O AT HAYDEN RD	43 00 46	76 37 00	6	30	70	7.17	5.6	1	35	4	WT
OWASCO O AT HAYDEN RD	43 00 46	76 37 00	7	2	70	5.83	5.6	2	69	5	WT
OWASCO O AT SH 31 PORT BYRON	43 02 06	76 37 39	6	30	70	7.00	3.7	1	35	4	WT
OWASCO O AT SH 31 PORT BYRON	43 02 06	76 37 39	7	2	70	5.75	3.7	2	69	6	WT
OWASCO O AT SH 38	43 03 43	76 38 05	6	30	70	6.75	1.6	1	35	4	WT
OWASCO O AT SH 38	43 03 43	76 38 05	7	2	70	5.58	1.6	2	69	5	WT
SKANEATELES CR ELIZABETH ST AT SK	42 56 56	76 26 08	11	18	70	8.25	14.3	1	3.2	2	WT
SKANEATELES CR ELIZABETH ST AT SK	42 56 56	76 26 08	11	18	70	8.25	14.3	1	3.2	2	WT
SKANEATELES CR ELIZABETH ST AT SK	42 56 56	76 26 08	11	19	70	6.45	14.3	2	6.7	2	WT
SKANEATELES CR ELIZABETH ST AT SK	42 56 56	76 26 08	9	7	71	13.25	14.3	3	11	4	WT
SKANEATELES CR AT MOTTVILLE	42 58 23	76 26 40	11	18	70	8.05	12.3	1	9.1	2	WT
SKANEATELES CR AT MOTTVILLE	42 58 23	76 26 40	11	18	70	8.05	12.3	1	9.1	2	WT
SKANEATELES CR AT MOTTVILLE	42 58 23	76 26 40	11	19	70	6.30	12.3	2	10	2	WT
SKANEATELES CR AT MOTTVILLE	42 58 23	76 26 40	9	7	71	13.00	12.3	1	12	3	WT
SKANEATELES CR JORDAN RD SK FALLS	42 59 29	76 27 17	11	17	70	8.15	10.4	1	19	2	WT
SKANEATELES CR JORDAN RD SK FALLS	42 59 29	76 27 17	11	17	70	8.15	10.4	1	19	2	WT
SKANEATELES CR JORDAN RD SK FALLS	42 59 29	76 27 17	11	17	70	8.15	10.4	1	19	2	WT
SKANEATELES CR JORDAN RD SK FALLS	42 59 29	76 27 17	11	19	70	6.15	10.4	2	13	4	WT

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
CLYDE RIVER AT SENECA CANAL	0.0	1.9	800	5.55	0.50	6.50	0.43	6.72	0.41	8.25
OWASCO INLET AT SH 38	13.5	2.4	12	8.15	0.43	10.35	0.34	10.77	0.33	13.50
OWASCO INLET AT SH 38-RR	11.0	2.4	16	6.22	0.57	7.47	0.47	7.67	0.46	9.50
OWASCO INLET AT DEAD END ROAD	7.6	3.4	25	10.05	0.50	12.25	0.41	12.58	0.40	15.25
OWASCO INLET AT DEAD END ROAD	7.6	1.3	25	2.30	0.83	3.20	0.60	3.32	0.58	4.70
OWASCO INLET AT LONG HILL ROAD	4.6	3.0	30	6.77	0.65	8.67	0.51	9.33	0.47	12.37
OWASCO INLET AT LONG HILL ROAD	4.6	4.3	30	9.50	0.66	12.40	0.51	12.43	0.51	16.20
OWASCO INLET SH 38 NR MORAVIA	4.0	0.6	38	1.07	0.82	1.57	0.56	1.71	0.51	2.54
OWASCO O AT THROOPSVILLE	9.1	3.2	35	6.13	0.77	7.48	0.63	7.76	0.60	9.83
OWASCO O AT THROOPSVILLE	9.1	3.2	69	3.83	1.23	4.75	0.99	4.90	0.96	6.18
OWASCO O AT HAYDEN RD	5.6	3.5	35	6.40	0.80	8.10	0.63	8.46	0.61	10.70
OWASCO O AT HAYDEN RD	5.6	3.5	69	4.67	1.10	5.32	0.97	5.57	0.92	6.82
OWASCO O AT SH 31 PORT BYRON	3.7	1.9	35	3.33	0.84	4.33	0.64	4.69	0.59	6.73
OWASCO O AT SH 31 PORT BYRON	3.7	1.9	69	2.37	1.18	2.92	0.95	3.20	0.87	4.42
OWASCO O AT SH 38	1.6	2.1	35	7.30	0.42	9.25	0.33	10.06	0.31	13.40
OWASCO O AT SH 38	1.6	2.1	69	4.55	0.68	6.00	0.51	6.45	0.48	8.85
OWASCO O AT BRIDGE AT MOUTH	0.0	1.6	35	4.75	0.49	6.75	0.35	7.17	0.33	10.05
OWASCO O AT BRIDGE AT MOUTH	0.0	1.6	69	2.82	0.83	3.67	0.64	3.96	0.59	5.57
SKANEATELES CR AT WILLOW GLEN	13.3	1.0	8.0	5.95	0.25	7.40	0.20	7.67	0.19	9.75
SKANEATELES CR AT MOTTVILLE	12.3	2.0	9.1	8.00	0.37	10.00	0.29	10.40	0.28	12.80
SKANEATELES CR AT MOTTVILLE	12.3	2.0	10	6.55	0.45	7.80	0.38	8.02	0.37	9.85
SKANEATELES CR AT MOTTVILLE	12.3	2.0	12	4.75	0.62	6.05	0.48	6.43	0.46	8.60
SKANEATELES CR AT LONG BRIDGE	11.6	0.7	9.1	1.65	0.62	1.85	0.56	2.12	0.48	2.90
SKANEATELES CR JORDAN RD SK FS	10.4	1.9	12	4.45	0.63	5.45	0.51	5.72	0.49	7.30
SKANEATELES CR JORDAN RD SK FS	10.4	1.9	13	4.20	0.66	4.95	0.56	5.15	0.54	6.35
SKANEATELES CR AT HAMILTON RD	6.6	5.7	13	12.50	0.67	18.10	0.46	18.39	0.45	23.10
SKANEATELES CR AT DEPOT ST	10.1	0.3	20	0.15	2.93	0.40	1.10	0.47	0.94	0.77
SKANEATELES CR AT IRISH RD	9.5	0.9	21	1.35	0.98	2.25	0.59	2.47	0.53	3.97
SKANEATELES CR AT CHATFIELD RD	8.0	2.4	32	3.85	0.91	4.60	0.77	4.87	0.72	6.23
SKANEATELES CR AT HAMILTON RD	6.6	3.8	33	7.10	0.79	8.75	0.64	9.17	0.61	11.75

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

TABLE 1.--DATA FOR TIME-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER--CONTINUED

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO DAY YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)
SKANEATELES CR AT CHATFIELD RD	43 00 53	76 28 22	11 17 70	8.30	8.0	1	32	2 WT
SKANEATELES CR AT CHATFIELD RD	43 00 53	76 28 22	11 18 70	7.70	8.0	1	30	2 WT
SKANEATELES CR AT HAMILTON RD	43 01 47	76 27 48	11 19 70	5.95	6.6	1	33	4 WT
SKANEATELES CR AT HAMILTON RD	43 01 47	76 27 48	9 7 71	12.65	6.6	2	13	4 WT
SKANEATELES CR SH 31C NR JORDAM	43 03 10	76 27 54	11 17 70	7.35	3.9	1	49	2 WT
SKANEATELES CR SH 31C NR JORDAN	43 03 10	76 27 54	11 17 70	7.35	3.9	1	49	2 WT
NINEMILE CR AT SH 175 MARCELLUS	42 58 58	76 20 08	5 21 73	13.00	13.2	1	190	6 WT
NINEMILE CR AT SH 175 MARCELLUS	42 58 58	76 20 08	6 26 73	9.55	13.2	2	48	3 WT
NINEMILE CR AT SH 174 MARCELLUS	42 59 29	76 20 24	5 21 73	12.82	12.5	1	195	8 WT
NINEMILE CR AT SH 174 MARCELLUS	42 59 29	76 20 24	6 26 73	7.75	12.5	2	50	4 WT
NINEMILE CR AT SH175 MARCELLUS	42 58 58	76 20 08	5 21 73	13.00	13.2	1	190	6 WT
NINEMILE CR AT SH 175 MARCELLUS	42 58 58	76 20 08	6 26 73	9.55	13.2	2	48	3 WT
NINEMILE CR AT SH 174 MARTISCO	43 00 50	76 20 15	5 21 73	12.25	10.6	1	205	10 WT
NINEMILE CR AT SH 174 MARTISCO	43 00 50	76 20 15	6 26 73	7.95	10.6	2	80	8 WT
NINEMILE CR AT SH 5 CAMILLUS	43 02 20	76 18 31	5 22 73	7.27	7.2	1	230	12 WT
NINEMILE CR AT SH 5 CAMILLUS	43 02 20	76 18 31	6 26 73	7.40	7.2	1	99	12 WT
NINEMILE CR AT SH 174 MARTISCO	43 00 50	76 20 15	6 26 73	7.95	10.6	1	80	8 WT
NINEMILE CR AT WARNERS RD AMBOY	43 04 11	76 16 24	5 21 73	12.05	3.9	1	240	8 WT
NINEMILE CR AT ROAD BELOW AMBOY	43 04 38	76 15 50	5 22 73	6.95	2.9	1	240	10 WT
SENECA RIVER AT SH 96A	42 52 06	76 56 25	11 7 67	7.75	58.8	1	828	64 B
SENECA RIVER AT LOCK NO. 4	42 54 05	76 51 49	11 7 67	9.83	54.0	1	828	64 B
SENECA RIVER AT LOCK NO. 2&3	42 54 54	76 47 14	11 6 67	14.33	49.7	1	828	64 B
SENECA RIVER AT LOCK NO. 1	42 56 51	76 44 08	11 1 67	9.75	45.7	1	1000	128 B
SENECA RIVER AT JCT CLYDE RIVER	42 59 58	76 43 52	11 1 67	10.67	42.0	1	1370	160 B
SENECA RIVER AT PENN CENTRAL RR	43 03 22	76 42 02	11 1 67	11.25	37.2	1	2040	192 B
SENECA RIVER AT SH 38	43 04 44	76 38 45	10 31 67	9.50	33.9	1	2270	224 B
SENECA RIVER AT PENN CENTRAL RR	43 03 22	76 42 02	8 13 75	9.88	37.2	2	800	224 WT
SENECA RIVER AT SH 34	43 04 15	76 33 25	10 31 67	9.00	28.9	1	2300	192 B
SENECA RIVER AT SH 34	43 04 15	76 33 25	8 13 75	18.80	28.9	2	820	144 WT
SENECA RIVER AT RIVER RD	43 06 03	76 29 58	10 31 67	8.25	24.6	1	2350	768 B

B. SAMPLING SITES

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
SKANEATELES CR HAMILTON RD	6.6	1.4	49	1.60	1.28	2.00	1.03	2.07	0.99	2.63
SKANEATELES CR AT SH 31C	3.9	4.1	36	5.80	1.04	6.40	0.94	6.64	0.91	7.87
SKANEATELES CR AT SH 31 JORDAN	2.2	4.4	36	5.05	1.28	6.05	1.07	6.29	1.03	7.80
SKANEATELES CR AT SH 31 JORDAN	2.2	4.4	16	9.75	0.66	12.05	0.54	13.11	0.49	18.15
SKANEATELES CR SH 31 AT JORDAN	2.2	1.7	50	1.40	1.78	1.65	1.51	1.72	1.45	2.22
SKANEATELES CR AT MECHANIC ST	2.9	1.0	50	0.75	1.96	0.90	1.63	0.93	1.57	1.15
NINEMILE CR A SH 174 MARCELLUS	12.5	0.7	195	0.48	2.14	0.60	1.71	0.66	1.57	0.91
NINEMILE CR A SH 174 MARCELLUS	12.5	0.7	50	0.85	1.21	1.17	0.88	1.32	0.78	1.71
NINEMILE CR AT SH 174 MARTISCO	10.6	1.9	205	0.98	2.84	1.18	2.36	1.22	2.29	1.50
NINEMILE CR AT SH 174 MARTISCO	10.6	1.9	80	1.65	1.69	2.25	1.24	2.30	1.21	2.95
NINEMILE CR AT SH 174 MARTISCO	10.6	2.6	205	1.45	2.63	1.75	2.18	1.80	2.12	2.20
NINEMILE CR AT SH 174 MARTISCO	10.6	2.6	80	2.75	1.39	3.40	1.12	3.51	1.09	4.30
NINEMILE CR AT SH 5 CAMILLUS	7.2	3.4	230	3.30	1.51	3.85	1.30	3.97	1.26	4.75
NINEMILE CR AT SH 5 CAMILLUS	7.2	3.4	99	5.15	0.97	5.90	0.85	6.07	0.82	7.04
NINEMILE CR A WARNERS RD AMBOY	3.9	3.3	240	4.13	1.17	4.60	1.05	4.78	1.01	5.66
NINEMILE CR A RD BELOW AMBOY	2.9	4.3	98	6.80	0.93	7.90	0.80	8.32	0.76	10.50
NINEMILE CR A RD BELOW AMBOY	2.9	7.7	98	12.75	0.89	14.35	0.79	14.57	0.78	18.35
NINEMILE CR A RD BELOW AMBOY	2.9	1.0	249	0.49	2.99	0.75	1.96	0.78	1.89	1.13
NINEMILE CR AT I 690 LAKELAND	0.6	2.3	380	2.00	1.69	2.55	1.32	2.65	1.27	3.30
SENECA RIVER AT LOCK NO.4	54.0	4.8	828	6.75	1.04	7.90	0.89	8.23	0.86	9.95
SENECA RIVER AT LOCK NO. 2&3	49.7	4.3	828	7.67	0.82	8.42	0.75	9.33	0.68	11.54
SENECA RIVER AT LOCK NO. 1	45.7	4.0	1000	2.77	2.12	5.84	1.00	5.62	1.04	7.17
SENECA RIVER AT JCT CLYDE R	42.0	3.7	1000	6.75	0.80	8.00	0.68	8.21	0.66	10.65
SENECA R AT PENN CENTRAL RR	37.2	4.8	2040	7.98	0.88	9.78	0.72	10.18	0.69	12.93
SENECA RIVER AT SH 38	33.9	3.3	2270	4.00	1.21	5.00	0.97	5.16	0.94	6.80
SENECA RIVER AT SH 34	28.9	5.0	820	30.12	0.24	37.62	0.19	39.88	0.18	51.12
SENECA RIVER AT SH 34	28.9	8.3	2300	8.00	1.52	9.00	1.35	9.33	1.30	11.15
SENECA RIVER AT RIVER RD	24.6	4.3	2350	7.00	0.90	8.25	0.76	8.29	0.76	9.65
SENECA RIVER AT RIVER ROAD	24.6	4.3	870	16.40	0.38	18.80	0.34	20.51	0.31	26.00
SENECA RIVER AT JONES POINT	22.3	2.3	2400	13.55	0.25	14.75	0.23	14.81	0.23	15.75

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

TABLE 1.--DATA FOR TIMF-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER--CONTINUED

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO	DAY	YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)	
SENECA RIVER AT JONES POINT	43 06 42	76 27 30	10	30	67	14.50	22.3	1	2400	384	B
SINECA RIVER AT JONES POINT	43 06 42	76 27 30	8	11	75	13.42	22.3	2	1100	640	WT
SENECA RIVER AT SH 48 LOCK 24	43 09 25	76 19 57	10	25	67	9.50	12.3	1	2430	224	B
SENECA RIVER AT SH 48 LOCK 24	43 09 25	76 19 57	8	11	75	14.50	12.3	2	1310	256	WT
SENECA RIVER AT SH 370	43 07 49	76 15 14	10	24	67	15.00	6.8	1	2670	160	B
SENECA RIVER AT SH 370	43 07 49	76 15 14	8	11	75	14.92	6.8	2	1400	256	WT
SENECA RIVER AT SH 31	43 10 33	76 16 37	10	24	67	5.75	2.0	1	2670	192	B
SENECA RIVER AT SH 31	43 10 33	76 16 37	8	11	75	12.92	2.0	2	1400	96	WT
SCONONDOA CR AT SH 234 VFRNON	43 05 01	75 32 32	8	26	70	7.15	5/18.2	1	6.1	12	WT
SCONONDOA CR AT WILLIAMS ST	43 04 48	75 35 24	8	26	70	6.90	5/15.4	1	6.1	6	WT
SCONONDOA CR AT SHOLTZ RD	43 04 59	75 37 20	8	26	70	6.60	5/13.5	1	6.1	6	WT
ONEIDA CR AT SCONONDOA ST ONEIDA	43 05 51	75 38 22	8	25	70	6.75	11.4	1	28	4	WT
ONEIDA CR AT SH 46 DURHAMVILLE	43 06 54	75 40 10	8	24	70	23.15	8.8	1	28	8	WT
ONEIDA CR AT SWALLOW RD	43 08 23	75 42 29	8	25	70	6.45	4.2	1	28	4	WT
ONEIDA CR AT SH 31	43 09 17	75 43 16	8	24	70	16.10	2.4	1	28	4	WT
COWASELON CR AT SH 13 NR CANASTOTA	43 05 44	75 45 05	8	2	71	13.50	7.5	1	25	8	WT
COWASELON CR AT SH 13 NR CANASTOTA	43 05 44	75 45 05	8	3	71	12.60	7.5	2	46	7	WT
COWASELON CR AT ONIONTOWN	43 07 02	75 49 51	8	2	71	13.10	3.2	1	30	4	WT
LIMESTONE CR AT FAYETTEVILLE DAM	43 01 54	76 00 51	9	1	70	16.75	8.6	1	25	15	WT
LIMESTONE CR MINOA RD MANLIUS CTR	43 04 00	76 00 03	9	1	70	16.55	5.4	1	40	12	WT
LIMESTONE CR AT KIRKVILLE RD	43 05 18	75 59 39	8	31	70	18.50	2.5	1	40	10	WT
CHITTENANGO CR AT TUSCARORA RD	43 03 14	75 52 10	9	1	70	17.75	23.2	1	21	24	WT
CHITTENANGO CR AT BOLIVAR RD	43 05 13	75 53 46	9	1	70	17.50	19.8	1	21	20	WT
CHITTENANGO CR AT HOAG RD	43 05 14	75 55 47	9	1	70	17.25	17.2	1	22	18	WT
CHITTENANGO CR AT KIRKVILLE RD	43 05 19	75 57 15	8	31	70	18.35	15.0	1	23	18	WT
CHITTENANGO CR AT NORTH MANLIUS	43 05 59	75 58 34	8	31	70	18.00	11.9	1	24	8	WT
CHITTENANGO CR AT PECK RD	43 06 39	75 58 09	8	31	70	17.70	10.7	1	80	18	WT
CHITTENANGO CR AT OXBOW RD	43 08 08	75 57 10	8	31	70	17.50	6.6	1	85	16	WT
CHITTENANGO CR AT BRIDGEPORT	43 09 18	75 58 19	10	5	70	16.25	2.8	1	140	64	WT
ONEIDA RIVER AT BREWERTON	43 14 24	76 08 28	6	24	69	21.00	17.5	1	1470	192	WT

B. SAMPLING SITES

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
SENECA RIVER AT SH 48 LOCK 24	12.3	10.0	2430	20.50	0.72	29.50	0.50	32.04	0.46	45.30
SENECA RIVER AT SH 48 LOCK 24	12.3	10.0	1140	49.38	0.30	62.98	0.23	64.05	0.23	78.88
SENECA RIVER AT SH 370	6.8	5.5	2670	12.00	0.67	14.20	0.57	14.98	0.54	19.20
SENECA RIVER AT SH 370	6.8	5.5	1400	19.30	0.42	23.10	0.35	25.18	0.32	32.90
SENECA RIVER AT SH 31	2.0	4.8	2670	9.50	0.74	10.90	0.65	11.23	0.63	13.90
SENECA RIVER AT SH 31	2.0	4.8	1400	14.68	0.48	17.18	0.41	18.79	0.37	24.48
SENECA RIVER AT THREE RIVERS	0.0	2.0	2670	3.75	0.78	4.25	0.69	4.67	0.63	5.90
SENECA RIVER AT THREE RIVERS	0.0	2.0	1400	5.23	0.56	5.48	0.54	5.91	0.50	7.15
SCONONDOA CR AT WILLIAMS ST	5/15.4	2.8	6.1	6.85	0.60	9.35	0.44	10.62	0.39	16.35
SCONONDOA CR AT SHOLTZ RD	5/13.5	1.9	6.1	8.10	0.34	11.60	0.24	12.59	0.22	18.35
ONEIDA CR AT SCONONDOA ST	11.4	2.1	24	10.20	0.30	13.70	0.22	14.05	0.22	18.00
ONEIDA CR AT SH 46 DURHAMVILLE	8.8	2.6	28	7.00	0.54	8.75	0.44	9.16	0.42	11.75
ONEIDA CR AT SWALLOW RD	4.2	4.6	28	23.60	0.29	28.35	0.24	28.89	0.23	35.35
ONEIDA CR AT SH 31	2.4	1.8	28	4.80	0.55	6.05	0.44	6.58	0.40	8.95
ONEIDA CR AT SH 13	0.1	2.3	28	31.90	0.11	40.90	0.08	41.72	0.08	51.90
COWASELON CR AT ONIONTOWN	3.2	4.3	30	6.10	1.03	7.50	0.84	7.53	0.84	8.70
COWASELON CR AT ONIONTOWN	3.2	4.3	53	4.90	1.29	6.50	0.97	6.66	0.95	8.00
COWASELON CR AT END DITCH RD	1.6	1.6	40	4.90	0.48	5.65	0.42	5.76	0.41	6.55
LIMESTONE CR AT KIRKVILLE RD	2.5	6.1	40	26.25	0.34	32.00	0.28	31.96	0.28	40.25
LIMESTONE CR AT KIRKVILLE RD	2.5	2.9	40	16.45	0.26	19.05	0.22	19.61	0.22	24.15
LIMESTONE CR AT N MANLIUS RD	0.2	2.3	55	10.25	0.33	12.75	0.26	13.03	0.26	16.30
CHITTENANGO CR AT BOLIVAR RD	19.8	3.4	21	31.75	0.16	43.25	0.12	43.14	0.12	57.25
CHITTENANGO CR AT HOAG RD	17.2	2.6	22	16.50	0.23	19.30	0.20	19.61	0.19	23.70
CHITTENANGO CR AT KIRKVILLE RD	15.0	2.2	23	15.75	0.20	19.00	0.17	19.41	0.17	23.55
CHITTENANGO CR AT N MANLIUS	11.9	3.1	24	17.65	0.26	21.65	0.21	22.06	0.21	26.45
CHITTENANGO CR AT PECK RD	10.7	1.2	80	1.50	1.17	2.50	0.70	2.88	0.61	4.54
CHITTENANGO CR AT OXBOW RD	6.6	4.1	85	14.60	0.41	17.00	0.35	18.17	0.33	22.70
CHITTENANGO CR AT BRIDGEPORT	2.8	3.8	87	25.50	0.22	31.75	0.18	33.09	0.17	41.50
CHITTENANGO CR AT MOUTH	0.0	2.8	140	16.25	0.25	24.25	0.17	28.03	0.15	39.85
ONEIDA RIVER AT CAUGHDENOY	13.2	4.3	1470	13.00	0.49	15.00	0.42	15.56	0.41	18.30

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

TABLE 1.--DATA FOR TIME-OF-TRAVEL STUDIES IN THE OSWEGO RIVER BASIN, IN DOWNSTREAM ORDER--CONTINUED

A. INJECTION SITES

STREAM IDENTIFICATION AT INJECTION SITE	LATITUDE ° ' "	LONGITUDE ° ' "	DATE AND TIME OF INJECTION MO	DAY	YR	HR	MILES ABOVE MOUTH	RUN NO.	INJECTION DISCHARGE (CFS)	AMOUNT AND TYPE DYE INJECTED (OUNCES)	
ONEIDA RIVER AT CAUGHDENOY	43 16 13	76 12 24	6	24	69	21.41	13.2	1	1470	192	WT
ONEIDA R ERIE CANAL AT OAK ORCHARD	43 12 17	76 13 05	6	24	69	6.87	7.8	1	1470	96	WT
ONEIDA R ERIE CANAL AT OAK ORCHARD	43 12 17	76 13 05	10	6	69	17.75	7.8	2	200	192	WT
ERIE CANAL AT HORSESHOE ISLAND US	43 12 59	76 14 50	6	24	69	6.70	2.3	1	1120	32	WT
ERIE CANAL AT HORSESHOE ISLAND US	43 12 59	76 14 50	10	6	69	17.00	2.3	2	150	64	WT
ONEIDA RIVER AT HORSESHOE I US	43 13 01	76 14 46	6	25	69	10.67	6.0	1	370	96	WT
ONEIDA RIVER AT HORSESHOE I US	43 13 01	76 14 46	10	6	69	16.75	6.0	2	50	192	WT
ONEIDA R ERIE C AT HORSESHOE I DS	43 13 00	76 15 53	6	24	69	6.63	1.3	1	1490	64	WT
ONEIDA R ERIE C AT HORSESHOE I DS	43 12 51	76 15 51	10	6	69	16.50	1.3	2	200	64	WT
OSWEGO R AT THREE RIVER POINT	43 12 06	76 16 50	10	23	67	15.50	24.1	1	4100	160	B
OSWEGO R LOCK NO. 1 AT PHOENIX	43 13 45	76 18 11	10	17	67	18.00	21.9	1	1900	704	B
OSWEGO R AT ARMSTRONG CORK	43 21 17	76 25 37	10	17	67	17.00	9.1	1	2300	384	B
OSWEGO R AT LOCK NO. 5	43 24 00	76 28 24	10	17	67	14.83	5.1	1	1970	272	B

B. SAMPLING SITES

STREAM IDENTIFICATION AT SAMPLING SITE	MILES ABOVE MOUTH	MILES TRAVELED	SAMPLING DISCHARGE (CFS)	LEADING EDGE T-T (HR)	LEADING EDGE VELOCITY (FT/S)	PEAK T-T (HR)	PEAK VELOCITY (FT/S)	CENTROID T-T (HR)	CENTROID VELOCITY (FT/S)	10-PERCENT TRAILING EDGE T-T (HR)
ONEIDA R ERIE C AT OAK ORCHARD	7.8	5.4	1470	12.59	0.63	14.74	0.54	15.23	0.52	18.29
ONEIDA R ERIE C HORSESHOE I US	6.0	1.8	1490	4.13	0.64	5.75	0.46	5.87	0.45	7.23
ONEIDA R ERIE C HORSESHOE I US	6.0	1.8	200	14.75	0.18	21.25	0.12	27.97	0.09	48.25
ERIE CANAL AT HORSESHOE I DS	1.3	1.0	1120	2.93	0.50	3.75	0.39	3.71	0.40	4.33
ERIE CANAL AT HORSESHOE I DS	1.3	1.0	150	19.00	0.08	29.00	0.05	31.00	0.05	44.50
ONEIDA R AT HORSESHOE I DS	1.3	4.7	370	6.33	1.09	11.33	0.61	11.72	0.59	16.73
ONEIDA R AT HORSESHOE I DS	1.3	4.7	50	28.75	0.24	38.25	0.18	39.69	0.17	51.75
ONEIDA R ERIE C AT SH 57	0.1	1.2	1500	3.37	0.52	4.02	0.44	4.02	0.44	4.69
ONEIDA R ERIE C AT SH 57	0.1	1.2	200	13.50	0.13	19.50	0.09	24.16	0.07	38.80
OSWEGO R LOCK NO. 1 AT PHOENIX	21.9	2.2	4200	4.20	0.77	5.60	0.58	5.93	0.54	8.30
OSWEGO R AT LOCK NO. 3	11.7	10.2	1910	40.00	0.37	47.50	0.32	48.02	0.31	60.00
OSWEGO R AT LOCK NO. 5	5.1	4.0	1970	10.00	0.59	13.20	0.44	14.71	0.40	19.80
OSWEGO R AT LOCK NO. 6	1.7	3.4	1970	21.17	0.24	24.37	0.20	24.84	0.20	29.57

1/ MILES ABOVE MOUTH OF KEUKA INLET
2/ MILES ABOVE MOUTH OF GANARGUA CREEK
3/ MILES ABOVE MOUTH OF CLYDE RIVER AND ERIE CANAL
4/ MILES ABOVE MOUTH OF WEST RIVER
5/ MILES ABOVE MOUTH OF ONEIDA CREEK

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